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LOW INTENSITY RADIUM ELEMENT NEEDLES

JANEWAY LECTURE, 1949*

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IT is my privilege today to pay tribute to two great men—Henry Harrington Janeway in whose honor this lecture was conceived and Gordon Richards who except for his untimely passing would now be standing before you. It was not my good fortune to know Dr. Janeway but the stimulating friendships and generous cooperation accorded me by the small group of scientists who worked with him and were inspired by his genius have placed me forever in his debt.

Gordon Richards was a personal friend blessed with the natural ability and wide experience which made him one of the world's top-ranking radiotherapists. A Janeway Lecture detailing his ingenious techniques and reviewing his voluminous, carefully kept records would have far surpassed anything that I can possibly present to you.

In casting about for a subject worthy of this occasion I have, with some misgivings, elected to discuss the trials and tribulations of a lone individual intent upon developing a worthy type of interstitial radium therapy at a great distance from the large, well equipped radiation centers. Interstitial radium provides the most efficient medium for the delivery of a given biological effect in an accessible tumor and it is not surprising that Alexander Graham Bell writing to Dr. Zowers[44] in 1903 stated: "but there is no reason why a tiny fragment of radium sealed up in a fine glass tube should not be inserted into the heart of a cancer, thus acting directly upon the diseased material."

In 1916 Failla succeeded in sealing radon into fine glass capillary tubes and Quick[38] states that the work done with such implants from 1917 to 1925 at the Memorial Hospital "went a long way toward eliminating the fallacious surface applications then so universally employed and in calling attention to the ultimate possibility of interstitial irradiation." The severe caustic reaction produced by the glass radon seed aroused much criticism, and in 1924 Failla perfected a method for sealing radon into tiny gold tubes which provided sufficient filtration to eliminate much of this untoward reaction.

My first radium therapy was carried out in 1920. Since I lived at a great distance from New York, radon seeds were not made immediately available and only radium element needles could be obtained for interstitial work. At that time most of the

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standard needles provided by the manufacturers contained relatively large amounts of radium and had steel walls which filtered out only a portion of the irritating beta rays. In such resistant structures as the uterine cervix they were used with some success, but the sloughs and painful reactions produced in intra-oral lesions made this work most unsatisfactory and I finally decided to abandon interstitial needle therapy altogether.

An address delivered before this Society by Prof. Claude Regaud[41] of Paris, France, in 1924 renewed my interest. He made it obvious that the needles at my disposal were incorrectly designed and that my methods were not based on sound principles. Among other things he stated that "Radium therapy should employ ultra-penetrating gamma rays filtered by heavy metals as recommended by Dominici in 1907" and that "generally the treatment is most effective if continuous and extended over 6 to 10 days."

In a paper presented before our Society in 1925 Lenz[15] described the technique carried out at the Radium Institute in Paris with platinum-iridium needles containing 0.66 to 1.0 mg. of radium per centimeter of active length, but many of the prominent radiologists who took part in the discussion condemned radium needle therapy, probably because their experience had been similar to my own. Although I was convinced that interstitial radium therapy should form a valuable part of our armamentarium, this discussion left me uncertain and somewhat confused, and this state of uncertainty prevailed until 1927 when a preliminary report on the use of low intensity needles in the treatment of cancer of the tongue at the Westminster Hospital in London by Evans and Cade[10] was brought to my attention. Beautiful colored drawings were used by the authors to show complete regressions of cancers of the tongue produced without painful reactions. Much of this work was done with small platinum needles containing only 0.6 mg. of radium. Here then was a practical, inexpensive procedure which could be carried out by a radiologist with modest equipment located in a part of the world where radon seeds were not available.

In a small book entitled "Radium Treatment of Cancer" published by Cade[3] in 1929, low intensity radium needles were described in some detail and practical techniques for their use in various parts of the body were outlined. The author stated that he made free use of the teachings of the Curie Foundation in Paris and the Radium Institute in Brussels and it was obvious that the low intensity needle which he described fulfilled the requirements of Regaud. Implantations of intra-oral lesions with small 0.66 mg. needles were first carried out in our Clinic in 1930. It became evident at once that the reactions were much milder and healing much more prompt than with the older types of steel needles.

TYPES OF RADIUM NEEDLES

If radium needles are to be left in the tissue for periods of six to ten days it is essential that the filtration be sufficient to remove all of the beta rays and that not more than 1.0 mg. of radium, and preferably less, be placed in each centimeter of active length. Cade[4] states that most of the needles now used in his clinic contain 0.66 mg. or 1.0 mg. per centimeter of active length. He states further that the odd figure of 0.66 was selected because 0.66 mg. of radium element used for one hour is equivalent to 5 microcuries destroyed. Some of the needles used by Paterson[30] contain as little as 0.3 mg. per centimeter of active length and he finds such weak loading useful in holding down the dose in the center of a large implantation. Cade insists that the radium be evenly distributed throughout the hollow portion of the needle but others have recently suggested that the concentration be greatest at each end. Such a loading would tend to make the linear dosage uniform rather than highest in the center as it is with standard needles. Other drawbacks of the standard needles are the eyes and points which provide no radioactivity and sometimes render accurate implantations difficult. Myers[29] has suggested

the use of wires made of cobalt[60] which can be made radioactive from one end to the other except for a thin nickel cover designed to eliminate the soft beta rays. The chief objection to such applicators is the short half life of 5.3 years of cobalt[60] which would make dosage calculations rather complicated.

All are agreed that the needles should be constructed of gold or platinum-iridium and that a wall thickness of 0.5 mm. of platinum-iridium is sufficient to provide proper filtration. However, most of the needles used in England have wall thicknesses varying from 0.6 to 0.8 mm. which provide added strength rather than necessary filtration. Paterson recommends hollow sheaths made to receive short unit cells having wall thicknesses of 0.2 mm. but the larger external diameters of such needles make implantations somewhat awkward in certain locations.

In an effort to simplify implantation techniques I use low intensity needles of only three sizes (Fig. 1). They have over-all lengths of 11.0, 27.0 and 51.0 mm.; they contain 0.66, 1.33 and 2.4 mg. of radium sulphate, and have active lengths of 0.5, 1.5 and 4.0 cm., respectively. The smallest container is a substitute for a radon seed and may be looked upon as a point source. The other two have loadings of 0.88 and 0.66 mg. per centimeter of active length. This arrangement has proved quite satisfactory in practice and falls in line with Paterson's observation that 0.33 mg. per centimeter is rather light and 1.0 mg. per centimeter is rather strong. The smallest container has an over-all diameter of 1.5 mm. with a wall thickness of 0.5 mm. and the others each have an over-all diameter of 1.75 mm. and a wall thickness of 0.6 mm. Some are made with dull trocar points which can hardly be forced through the tough wall of an artery, while others are provided with sharp points more suitable for insertion into hard tumor tissue.

RADON SEEDS VS. RADIUM NEEDLES

After Failla[11] described filtered radon implants in 1926 they were almost universally adopted for interstitial therapy in this country and Martin and Sharp[28] published an article in 1931 extolling their points of superiority over radium needles. Although my own experience with low intensity needles was still quite limited, they seemed such a satisfactory substitute for radon seeds that I felt impelled to publish an article[17] comparing the two types of interstitial therapy in 1932. A conviction that the quantity of radiation needed to pro-

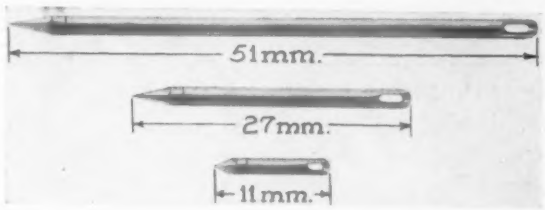

Fig. 1. Scale drawing of the three radium needles used by the author. They contain 2.4, 1.33 and 0.66 mg. of radium, respectively.

duce a given biological effect was less with the needles than with radon was soon dissipated by Failla but the other advantages claimed at that time still hold good. Chief among them is the more even distribution obtainable with the longer radium implants. As a rule, a preconceived pattern can be set up in the tissues so that it delivers a given dose. If roentgenograms show an uneven distribution, the positions of the needles can be readily readjusted. Even when seeds are implanted with great care the distribution patterns are often quite poor and unless removable seeds are used rearrangement is impossible. Most of the radon implants available in this country have a wall thickness of 0.3 mm. With this type of filtration almost 9.0 per cent of the transmitted radiation consists of beta rays. Although Failla believes that this relatively small quantity of the more destructive type of radiation can do little harm, it is my opinion that it increases the number of undesirable reactions, particularly when used in the mouth or near the mucosa of the bowel.

Low intensity needles are always stitched in place and attached to a guy thread so that they can be recovered even when the

stitches pull loose. Some tumors melt down rather rapidly and seeds may slip out of position and be lost. This disadvantage assumes real importance in intra-oral work because the small foreign bodies can be aspirated and they have on several occasions produced lung abscesses. When they remain in their proper positions they become multiple foreign bodies retained in the healed scar, a condition which does not seem entirely desirable in itself.

On purely theoretical grounds it has been claimed that the rapidly diminishing intensity of the radioactivity produced by radon does not produce the same effect on a malignant cell as the steady output of radium. If it be true that a given intensity should be maintained until a certain number of mitoses have taken place this contention may be worthy of consideration but clinical results do not seem to support it.

On the other side of the picture it should be pointed out that seeds may be placed in locations which are inaccessible for needle implantations, and it is also true that the patient may go home immediately after they are placed in position thereby avoiding the stay in the hospital required for needle therapy. However, for many patients with cancer a short stay in a good hospital may prove quite advantageous in that helpful measures consisting of the treatment of anemia, correction of nutritional deficiencies and proper hygiene can be instituted. The physician can also be certain that the radioactive sources are retained in their proper positions during the entire course of treatment. Some have contended that the larger needles produce much more discomfort than seeds but post-implantation discomfort has been mild in my experience even when large areas are covered.

DOSAGE

The estimation of tissue doses produced by interstitial implants is not simple and it has proved so baffling to some radiologists that they have limited their therapeutic activities to roentgen therapy possibly because less skill and time are required and most of the work can be delegated to technicians. Fortunately, everyone does not accept the pessimistic attitude of Ackerman and del Regato[1] who state that an accurate dosimetry is not possible with the use of radium.

In 1934 Paterson and Parker[31] published data which placed low intensity radium needle therapy on a sound basis. They stressed the importance of the time factor and observed that with an exposure time of eight days a dose of 6,000 gamma roentgens delivered to the whole of a tumor and the tumor-bearing zone produced permanent resolution of the majority of the epitheliomata so treated. They also observed that most areas in the mouth would tolerate doses of 12,000 gamma roentgens without the formation of permanent necroses. The mucosa of the vagina was found to have a similar tolerance but the maximum safe dose for the rectal mucosa was given as 10,000 gamma roentgens. Smaller doses were advised for larger volumes of tissue in which the total amount given should not exceed 7,000 gamma roentgens. These figures established the limits between which all dosage should be set in practical work and patterns were described for areas of different sizes and shapes designed to deliver a fairly uniform dose of approximately 6,000 gamma roentgens to all malignant tissue in a given region. In 1938 the same authors[32] published curves from which the number of milligram hours needed to produce 1,000 gamma roentgens under stated conditions could be obtained for both planar and volume implants.

Although these curves were very valuable they left much to be desired. In 1944 Quimby[39] published tables which were of great practical value because they provided data from which doses could be estimated at any point in a tumor implanted with needles regardless of the pattern or types of needles employed. However, even when these data were made available it was necessary to lay out the implantation patterns on paper in two dimensions if accurate calculations were to be carried out and such a procedure was too involved for practical use.

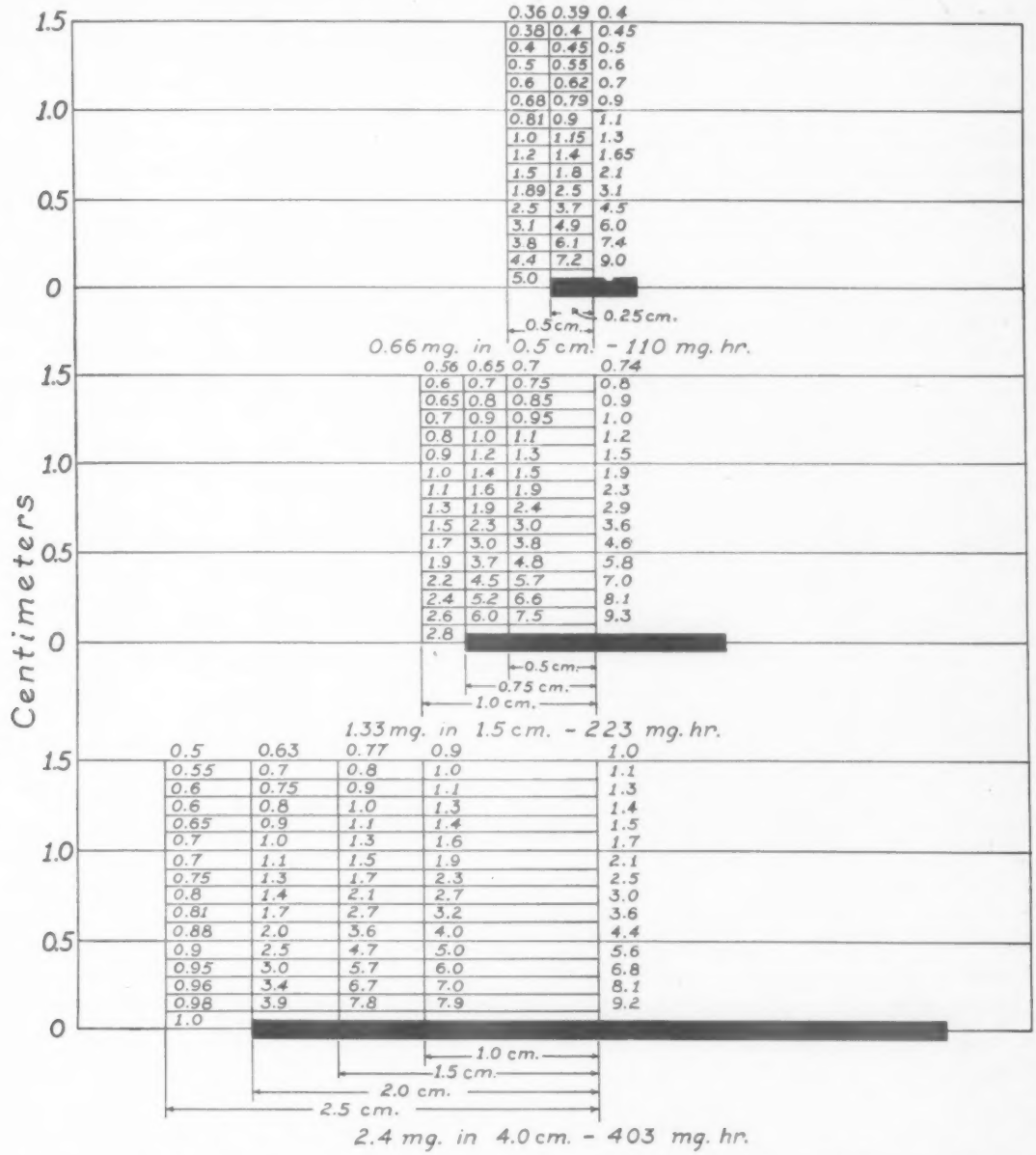

Fig. 2. Dosages delivered in seven days about the active lengths of the three needles illustrated in Figure 1. The figures must be multiplied by 1,000 to convert them into gamma roentgens.

In our Clinic the problem was simplified by fixing the time of all implantations at seven days. It was then possible with the aid of Quimby's tables to prepare a chart depicting the doses in gamma roentgens delivered at multiple designated points about the active lengths of the three needles described above (Fig. 2). From these data the total dose delivered to any point in a tumor by all of the needles implanted could be easily calculated after the pattern had been laid out in two dimensions. Studies were first made on layers of tissue having a thickness of 0.5 cm. and it was soon found that the three needles adopted could be placed in standard patterns and spaced 1.0 cm. apart so that all of the cells in the layer would receive doses ranging between 6,000 and 12,000 gamma roentgens. It is obvious then that in practice one of these standard patterns can be used thereby eliminating all calculations. With large tumors having

unusual shapes two or more patterns must be combined and at times this procedure poses a difficult problem, but therein lies the art of medicine which no amount of mathematical calculation can completely eliminate. None can deny that the uniform dosage advocated by Paterson and Parker would be preferable to this plan but its ease of application and the good results obtained seem to commend it.

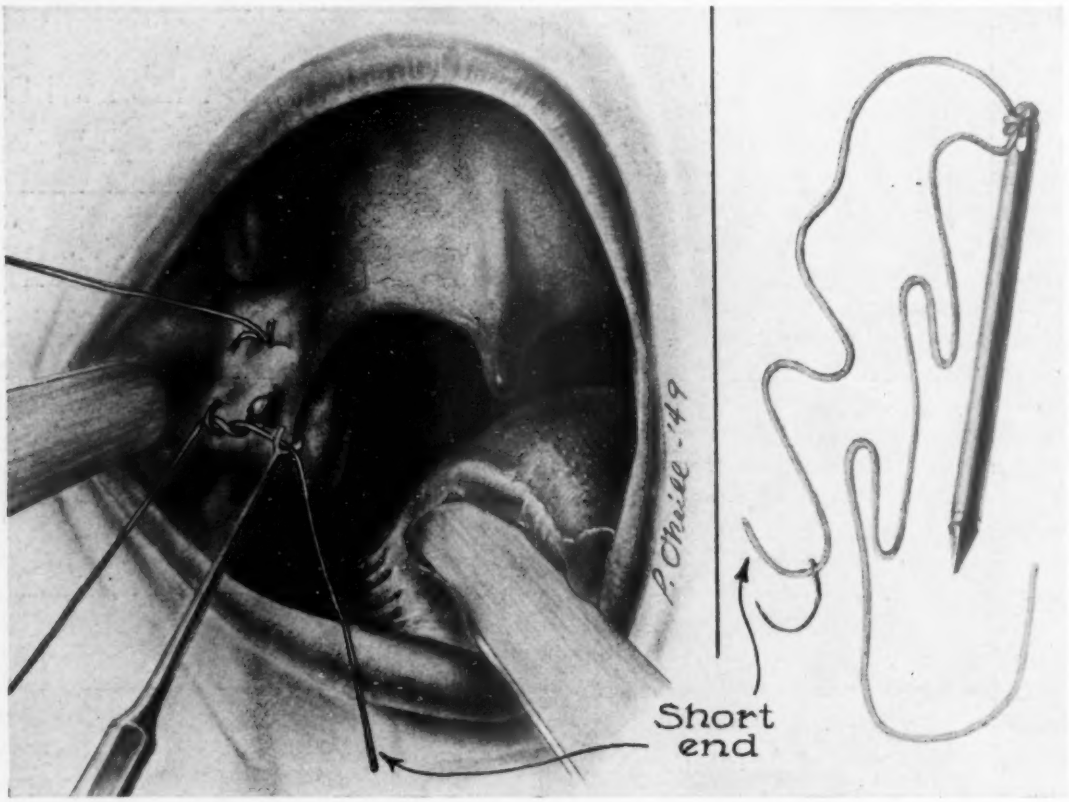

Fig. 3. Method used in stitching radium needles in the base of a tumor of the tonsil. The instrument with a Y-shaped tip may be used to tie knots in inaccessible locations without placing the fingers in the mouth.

TECHNIQUE

After a tumor has been measured and the approximate pattern decided upon, the correct number of radium needles of each size is placed on the loading bench and threaded with strong dental floss. This thread which is waxed and is supplied in sealed, sterile containers each holding 150 yards makes excellent suture material. The waxed strands do not become tangled in a wet field and no more comfortable suture material has been found for intra-oral work. After a long thread is passed through the eye of each needle it is knotted well to one side of its center so as to leave a long and a short portion free. The threaded needles, together with all of the sharp edged instruments to be used, are then submerged in a zephirin solution (1:1,000) for a period of five minutes. All other instruments are sterilized by boiling in a standard sterilizer. The radium needles are laid out on a table with a sterile cover placed well away from the operator and the instruments are placed on another sterile table situated near the operative field.

External skin surfaces to be implanted are scrubbed with green soap, painted with merthiolate and draped with sterile towels except near the eye, where 5 per cent mercurochrome is substituted for merthio-

late. For intra-oral work the mouth is first sprayed with 2 per cent pontocaine after which the face is washed with soap and the mucous surfaces are painted with iodine before the drapes are put in place. For pelvic work the vagina is thoroughly scrubbed with green soap and painted with iodine.

Pelvic lesions are treated after the intravenous administration of sodium pentothal but in other locations local anesthesia is rapidly induced with 0.75 per cent butyn sulphate drawn from a 100 cc. bottle fitted with a permanent rubber diaphragm stopper which has been sterilized with alcohol. Contamination of the anesthetic remaining in the bottle is prevented by using an 18 gauge needle for withdrawal of the solution through the rubber diaphragm. This needle is always replaced by smaller gauge needles for the actual injections and it is never inserted into the tissues. The butyn which contains epinephrine is sterile when it comes from the manufacturer. It may be kept indefinitely, is always ready for immediate use and is quite economical because only the necessary amount need be withdrawn for the case at hand. Reactions are not encountered if the total amount of the anesthetic used does not exceed 20 cc. and if the patient receives an average dose of one of the barbiturates about two hours before the implantation is started. It is also customary to administer $\frac{1}{6}$ grain of morphine about one hour before the patient comes to the operating room. For intra-oral work the mouth must be rendered dry by giving 1/100 grain of atropine along with the morphine.

A specimen for study is next removed with biopsy forceps and all bleeding is controlled with electocoagulation. Every effort is then made to reduce the malignant tissue to be implanted to a single layer prior to implantation. This may be done by removing all projecting portions of a fungating tumor by electrocoagulation or by removing portions of the ear or nose with the endotherm knife. With some solid tumors where this cannot be accomplished radium needles are inserted immediately in a pattern designed to adequately irradiate the entire neoplasm. For implantations through intact skin, small incisions are made with a sharp scalpel at each needle site. All needles are countersunk beneath the surface with a long narrow rod having a depression in one end. After the implantation is completed each needle is stitched in place. This is accomplished with

Fig. 4. Method used in inserting needles behind a lesion on the lateral border of the tongue.

a curved needle threaded with the short suture attached to the eye of the radium needle. It is best to insert the sewing needle through the puncture wound and always to sew directly away from the lesion. The two threads are then knotted directly over the head of the radium needle and the excess portion of the short thread is cut away. The longer threads are finally tied together as guy threads and attached to an identification tag which is firmly fixed in some convenient location with adhesive tape.

All patients remain in the hospital for seven days. External implanted areas are cleansed daily and dressed with boric acid ointment. With intra-oral lesions a mouth wash is used after each meal and the treated area is painted with 5 per cent mercurochrome. Needles inserted into the cervix, vaginal walls or parametria are not sutured but are held in place by gauze packs soaked

in a mixture of balsam peru in castor oil (a dram to the ounce). These packs are changed every other day.

At the end of 168 hours all needles are removed, usually without an anesthetic. When each suture is cut on the side of the knot away from the needle, removal by means of tension applied to the guy thread should not be too difficult. In some instances it is necessary to remove a deep-seated needle by grasping the outer end with a small hemostat inserted into the original puncture wound. Occasionally a needle buried in the parametrium must be guided through a puncture wound in the vaginal wall by the tip of a finger, but for the most part all of the work is done with instruments without bringing the fingers near the radioactive sources. On the few occasions when needles have been lost well below the surface, removal has been accomplished under roentgenoscopic control. Radiologists with war experience are well trained for this procedure. Patients who have had pelvic implantations are directed to use mild douches twice daily for a period of six weeks after leaving the hospital. All others continue the type of general care used in the hospital until the puncture wounds have healed and the irradiation reactions have subsided.

COMPLICATIONS

Under ideal conditions the radium reaction reaches its peak in about three weeks and has subsided in six weeks. Healing requires periods varying from six weeks to several months, depending upon the size of the area treated. With the technique recommended by the author some portions of the implanted region receive larger doses than others. For this reason they may heal slowly and in some instances small patches of necrosis may require special care. In wounds on skin surfaces such reactions often respond well to alvagel or to an ointment containing vitamins A and D. Persistent sloughs are removed by electrocoagulation or other surgical procedures. Deep-seated infected ulcers may be cleaned up rapidly with gauze packs soaked in a penicillin solution (100,000 units in 3 ounces of normal saline solution).

In the mouth daily applications of Scott's solution are very useful in clearing up small areas showing necrosis. It is usually made up to contain 2 gm. of gentian violet, 55 cc. of 95 per cent alcohol, 10 cc. of acetone and 35 cc. of distilled water. It is important that this substance be applied accurately to the involved region and not spread over the oral mucosa. When teeth are removed and infection is carefully controlled before implantation, bone necrosis is reduced to a minimum by the use of low intensity radium needles. However, in certain instances, particularly in the more advanced cases, some bone damage cannot be avoided. Daland[7] has recently published an excellent review of the proper care of this complication. Small segments of devitalized bone will often separate of themselves under expectant care continued for several months. In some instances healing is accelerated by removing exposed bone with electrocoagulation or with rongeurs. Extensive necrosis in the mandible should be treated by complete surgical excision. Surprisingly good function is preserved even when half of the mandible is resected.

HAZARDS

Everyone engaged in radiation therapy should give some thought to protecting himself against the hazards of his profession. Far too many have developed severe anemias and leukemias and the hands of most of the pioneers active in the development of radon seed techniques show serious damage. Departments of roentgenology are now provided with protective devices which should insure the health of those who work in them, and workers using radioactive materials should received equal protection. It is my opinion that low intensity radium element needles can be used so as to produce the least hazard of any of the radioactive sources available for therapy. The permanent heavy filter and the small amount of radium in each container reduces the intensity of radiation to which the operator is

exposed during the short time needed for an implantation to a very low figure. Since all manipulations are done with instruments and since the amount of radiation delivered at a distance of 2.0 cm. from the center of a low intensity needle in a few hours is almost negligible, the reasons for this statement are obvious. When the tips of the fingers are used to tie sutures or to facilitate the removal of a deep-seated container they are only brought near the ends of the needles which give off very little radiation. Perhaps the condition of the author's own hands provide the best evidence in favor of his contention. After a period of eighteen years during which many hundreds of low intensity needle implantations have been done no skin damage can be made out. The nails are somewhat brittle and show slight longitudinal ribbing but are otherwise normal. It might be added that some of these changes may have resulted from radiation received from other sources used in an active general radiological practice carried on during the past thirty years.

CANCER OF THE FACE, NECK AND EAR

In the southwestern portion of the United States the treatment of cancer of the exposed cutaneous surfaces constitutes one of the major problems encountered in a tumor clinic. Phillips[34] states that 33.8 per cent of 3,683 cancers recorded in the United States Public Health survey made for the Dallas-Fort Worth area in Texas in 1939 were cutaneous lesions. In my opinion, such tumors appearing on the dorsal surfaces of the hands respond best to electrocoagulation or excision, but most carcinomas of the face and neck may be eradicated with radiation therapy. The techniques used are described in a recent article.[24] The smaller lesions measuring 2 cm. or less in diameter receive low voltage roentgen therapy but the larger ones, particularly those showing extension into the deeper tissues, are treated with 200 kv. roentgen rays using a divided dose technique, or with low intensity radium needles. Fortunately neoplasms on the forehead, temples and cheek tend to grow in planes so that they are well suited for layer needle implantations, and when fungoid masses are encountered they can easily be removed by electrosurgery thereby converting the residual malignant tissue into flat masses. Large flat malignant ulcers often seen in the external cheek just in front of the ear tend to extend downwards into the parotid region and radical surgery almost invariably damages branches of the seventh cranial nerve and produces facial paralysis. These lesions respond quite well to low intensity radium needle implantations which never produce nerve injury. Primary cancer arising in the parotid gland may be treated in the same manner, with good cosmetic results.

Dermatologists tend to stress the importance of using smaller doses for basal than for squamous cell carcinomas. It has been our experience that large basal cell tumors are often quite radioresistant and for that reason the dosage used is the same regardless of the histopathological type revealed by biopsy studies. This so-called resistance to irradiation may be due to the fact that a careful search will often reveal cells of both types in the larger tumors. Some pathologists report squamous cell carcinomas as radiosensitive or radioresistant on the basis of Broders' classification. Since all of these tumors do equally well with the radium dosage recommended in this paper, such a classification is confusing to the uninitiated. In fact, the largest number of permanent cures is obtained with Grade 1 lesions because they tend to metastasize much later than the more radiosensitive types.

Many radiologists seem to share the opinion of Ackerman and del Regato who state that "interstitial curietherapy is an expeditious method of treatment which is only justified in small lesions." I would agree that an accurate implantation of radon seeds into large areas might prove quite difficult but the results illustrated in Figures 5 and 6 should convince the most

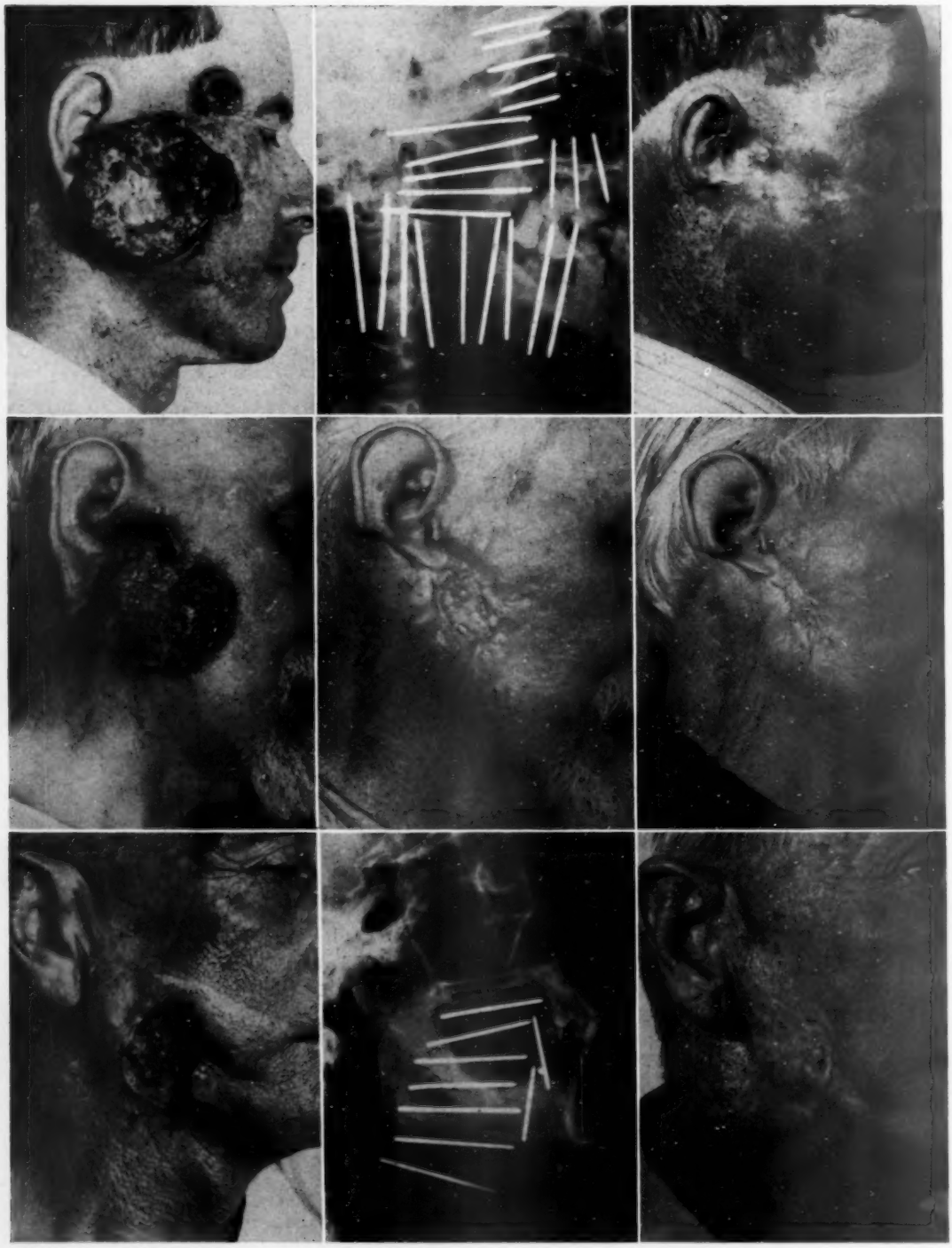

Fig. 5. Cancers of face. *Upper.* Mixed squamous and basal cell carcinoma, well four years and nine months after needle therapy without facial nerve damage. *Middle.* Large squamous cell carcinoma, well seven years after needle therapy showing no facial nerve damage. *Lower.* Deep-seated basal cell carcinoma, well four years and nine months after needle therapy. Although there is some scarring present the mouth can be fully opened.

skeptical that planar needle implants have a definite place in the treatment of massive deep-seated carcinomas of the face.

Many large cancers of the face and neck arise in or about the ear and the poor it is our custom to remove the damaged cartilage with electrosurgery before instituting any form of radiation therapy. Although some good results have been obtained with divided dose roentgen therapy

Fig. 6. Cancers of the face. *Upper.* Large basal cell carcinomas of the forehead complicating von Recklinghausen's disease, well three years and nine months after radium needle therapy. The deformity of the left eye resulted from the unsuccessful use of a cancer paste applied elsewhere. *Lower.* Squamous cell carcinoma, Grade 1, with radiation slough in center, well one year after excision of the slough and radium needle therapy.

results obtained with such lesions in general practice are described in a recent article[22] in which the observation is made that 72 per cent of the cases entering our Clinic had been treated unsuccessfully elsewhere. When the auricle shows extensive invasion we have come to depend more and more on radium needles for erradication of the residual malignant tissue in and about the auditory canal.

Patients who have been over-irradiated elsewhere and present themselves for treat-

TABLE I

ADVANCED CUTANEOUS CANCER OF THE FACE AND NECK TREATED WITH RADIUM NEEDLES

	Well 3 or More Years		Well 5 or More Years	
	Total Number	Well	Toal Number	Well
Face	55	25—45.4%	38	12—31.5%
Neck	20	8—40.0%	17	5—30.0%
Ear	53	23—43.4%	41	15—36.5%

ment with active carcinoma growing about a painful area of necrosis pose one of our most difficult problems. When possible, all devitalized tissue is removed with sharp scissors or by electrocoagulation before the needles are inserted under the active portions of the neoplasm. It is particularly important that all cartilage showing irradiation necrosis be removed as a preliminary procedure.

The results obtained with radium needles are tabulated in Table 1 In evaluating the relatively low five year salvage of 30 to 36 per cent it must be remembered that only the worst cases were treated with radium needle therapy and that most of the patients were quite old. In other words, many of them died in less than five years from distant metastases or other causes and many were untraced. The importance of this observation is emphasized by the fact that the primary lesions healed satisfactorily in 60 per cent of the entire series.

FIG. 7. Cancers of skin of neck. *Upper.* Large tricho-epithelioma of the skin, well one year after radium needle therapy and excision of the slough shown in the central photograph. *Lower.* Fungating squamous cell carcinoma, Grade 1, well two years after electrocoagulation followed by radium needle therapy.

Fig. 8. Cancers of the ear. *Upper.* Large squamous cell carcinoma completely undermining the ear, well four and a half years after removal of the pinna by electrosurgery and radium needle therapy. *Lower.* Squamous cell carcinoma, Grade 1, undermining the ear, well one year and ten months after removal of the pinna by electrosurgery and radium needle therapy.

CANCER OF THE CANTHI

The importance of cancer of the eyelids and canthi is emphasized by Driver and Cole[9] who observed 324 such lesions (16.8 per cent) in a series of 1,925 patients with epithelioma of the skin. Small carcinomas of the eyelids are treated with low voltage roentgen rays given with eye shields of the type described by Hunt,[13] but large lesions involving either canthus respond best to radium needle therapy. This is particularly true when the disease has extended well down into the orbit or has involved the bridge of the nose and the cheek. Satisfactory patterns can usually be worked out with the small 0.66 mg. radium needles which are often planted directly into tumors of the lids and I do not hesitate to insert a row of 1.33 mg. needles vertically into the outer portions of the orbit when deep extensions are present. It is also worthy of note that superficial lesions growing on the nose without cartilage involvement respond well to the same type of therapy (Fig. 9). In a series of 27 large tumors treated from 1937 to 1948 good primary healing was obtained in 24 (88.8 per cent). Of this group 73 per cent had been treated unsuccessfully elsewhere with caustics, surgery or some type of irradiation. The failures occurred in those patients having deep extension through the underlying bony structures. Of 15 patients

treated five or more years ago, 11 (or 73.3 per cent) have remained well. The commonest complication encountered in the inner canthus is an obstruction of the tear ducts from fibrosis during the healing stage. A good ophthalmologist can often keep these ducts open by careful dilatations started about one month after treatment. A slight conjunctivitis may follow irradiation and in 6 of our cases it persisted but caused very little discomfort. The danger of cataract formation secondary to irradiation has been discussed at some length by Hunt. Many of the patients with cancer of the inner canthus are in the old age group and have some clouding in the lenses of both eyes when they are first seen. In 3 of our cases this condition became noticably worse in the years immediately following therapy but the others reported no changes in their vision. Even when the needles were inserted well down into the orbit no muscle damage was observed in any of our patients. On the whole, it may be stated that the complications were not serious and the cosmetic results were superior to those resulting from radical surgery with enucleation of the eye.

Fig. 9. Basal cell carcinoma of the inner canthus, both eyelids, the right side of the nose and the upper lip, well two years after removal of the ala of the nose and radium needle therapy.

Cancer of the Lip

Most tumor clinics now recommend radical surgery for all but the earliest malignant lesions of the lips but I believe that

Table II

Advanced Cancer of the Lip Treated with Radium Needles

	Well 3 or More Years		Well 5 or More Years	
	Treated 1933–1946	Well	Treated 1933–1944	Well
All cases	88	36—40%	77	26—33.7%
Without nodes	37	18—48.6%	32	15—46.8%
With nodes	51	18—35.2%	45	11—24.4%

irradiation followed by surgical procedures in some instances, produces the best cosmetic results obtainable. Such tumors measuring less than 2.0 cm. in diameter are treated with low voltage roentgen rays

tumor tissue left after the removal of the projecting portions by electrosurgery is particularly well suited for this procedure. The restoration of the lower lip is often so satisfactory than no plastic procedures are

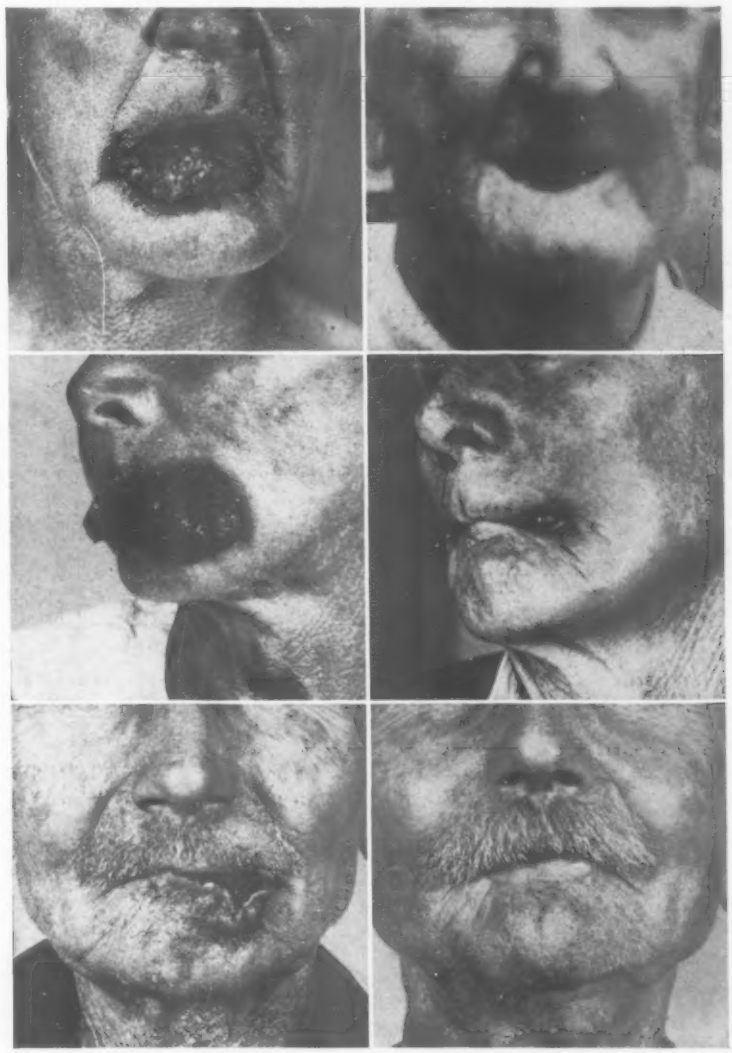

Fig. 10. Large cancers of the lip. *Upper.* Squamous cell carcinoma, Grade 2, well twelve years after radium needle therapy. *Middle.* Squamous cell carcinoma, Grade 1, well six years after electrosurgery and radium needle therapy. *Lower.* Squamous cell carcinoma Grade 1, well one year after radium needle therapy showing a restoration of the vermilion border without plastic surgery.

unless they are accompanied by deep infiltration, but most of the larger ones, regardless of their size, can be eradicated with a carefully worked out planar implantation of radium needles. Since the lip is a relatively thin structure the residual layer of

indicated. However, when cancer has infiltrated the entire lip and invaded the mucous surface, destruction of the neoplasm must of necessity destroy much of the lip and a plastic repair should follow irradiation to prevent the leakage of saliva.

Those who may feel inclined to criticize the low five year salvage of 33.7 per cent set down in Table 11 should take note of the fact that our material was very unfavorable. More than half of these patients had palpable cervical nodes at the time they were treated, and 25 were admitted for the treatment of the nodes after the primary lesion had been cured elsewhere. Many cases could not be traced for five years but a partial follow-up of 63 patients with large primary lip carcinomas showed that satisfactory healing was produced by radium alone in 51, or 80 per cent. In the remaining 20 per cent it was necessary to coagulate or excise small areas which were not cured by irradiation. In my opinion, these recurrences resulted from improper needle patterns and they should be eliminated as more experience is gained. The treatment of the metastatic nodes which was carried out with irradiation alone will be discussed in another portion of this paper.

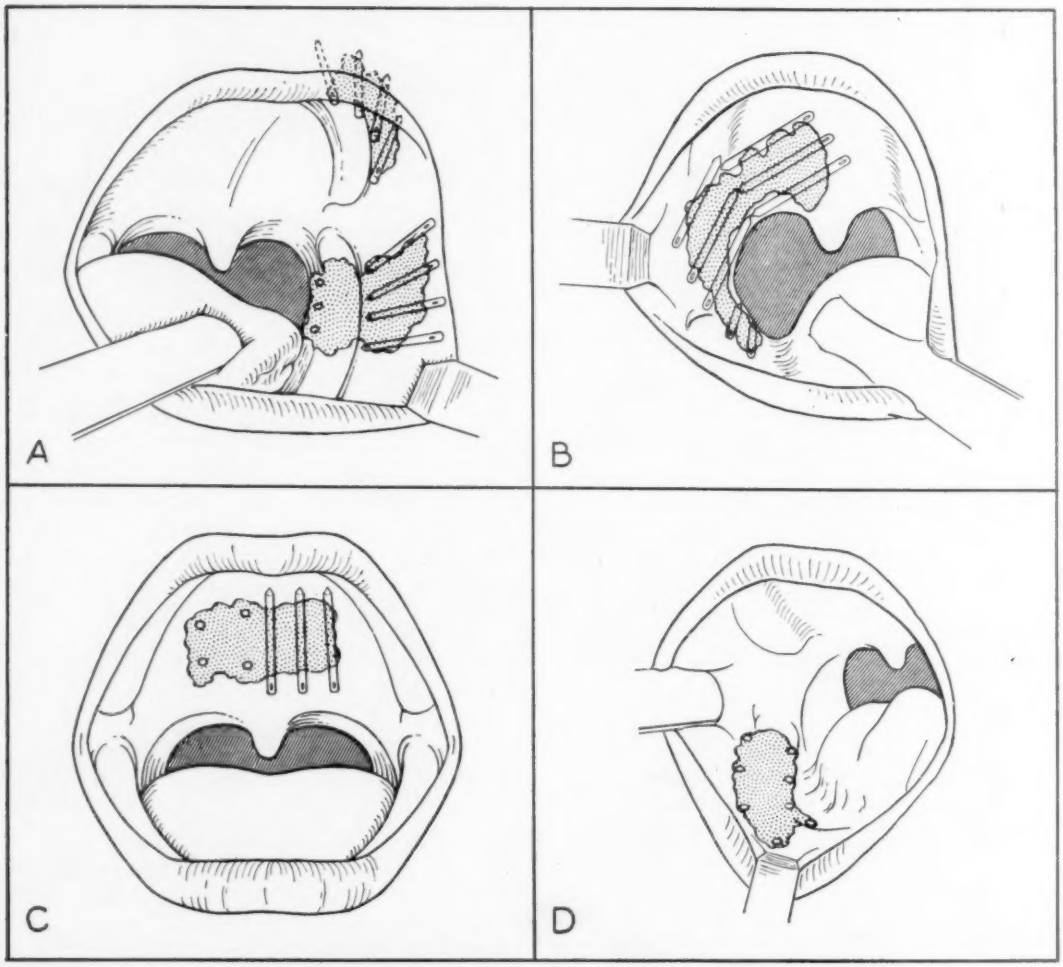

Fig. 11. Radium needle patterns used for cancers of the internal cheek, alveolar process and palate.

INTRA-ORAL CANCER

Intra-oral cancers, especially the larger, more complex tumors, present difficult surgical problems and even the more radical operators depend to some extent on irradiation. In this country most lesions in the mouth are treated with intra-oral cone

therapy, external roentgen therapy, intra-oral radium contact devices or implanted radon seeds. These techniques have been described by Richards,[42,43] Pfahler,[33] Cutler,[6] Martin and Sharp,[28] Martin and Pflueger,[27] and others. Even Cade and Paterson, who are enthusiastic about low intensity radium needles, limit their use to intra-oral lesions not in contact with bony structures. In an effort at simplification of equipment I have used such needles in all lesions in the mouth with the full knowledge that many authorities think this procedure is ill advised.

With the exception of bulky tumors located within the tongue, almost all cancers in the mouth can be converted into planes or combinations of planes for implantation. Here again some preliminary electrosurgery is often necessary and it is desirable that teeth in the field of treatment, particularly those about which infection is observed, be removed before radium is inserted. Adequate treatment of irregular tumors may require some ingenuity when they are extensive enough to involve more than one portion of the mouth. Some of the basic patterns are illustrated in Figures 11 and 12 but each case is a problem in itself and the operator must try to visualize the positions assumed by the needles after the mouth is closed. Postoperative roentgenograms often indicate that several readjustments are necessary. Some of the needles may become displaced after a few days, and in certain difficult cases reimplantations

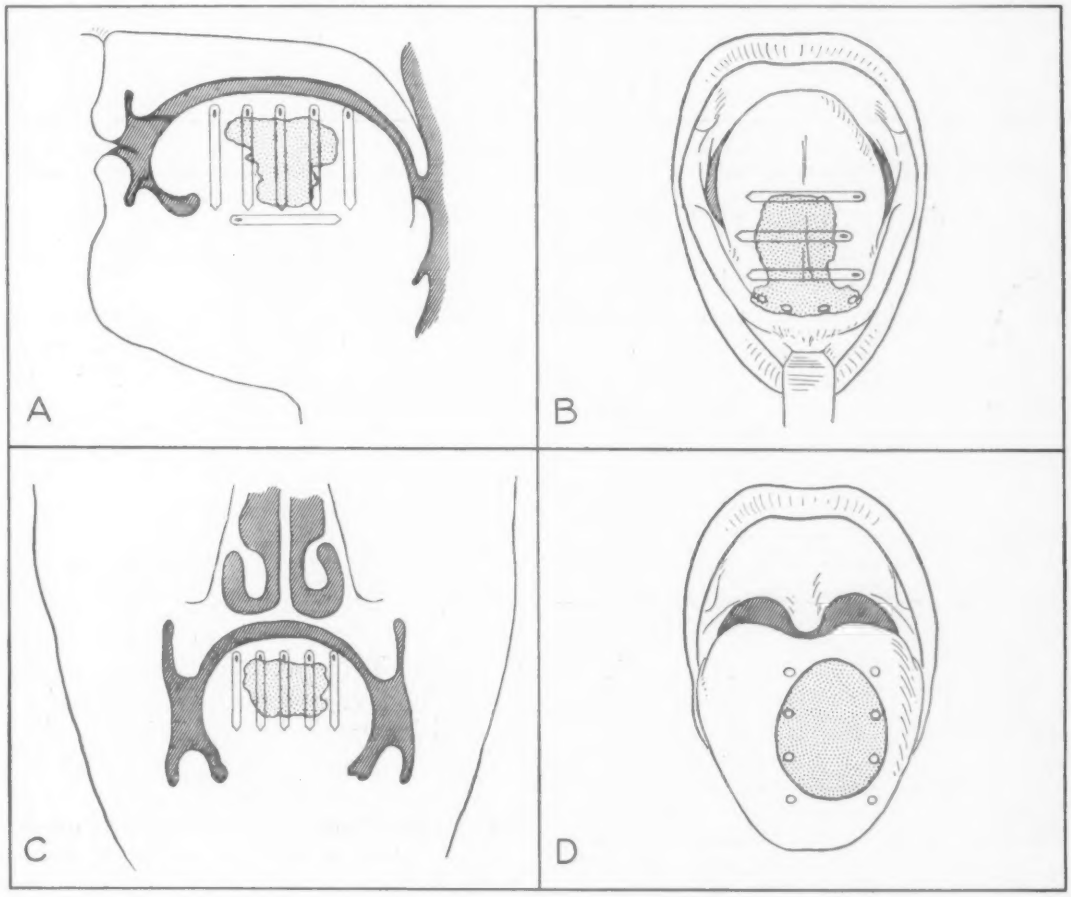

Fig. 12. Needle patterns used for cancer of the tongue. *A*—lateral border, *B*—under side with involvement of floor of mouth and alveolus, *C*—base of the tongue, and *D*—large central tumor.

Table III

INTRA-ORAL CANCER TREATED WITH RADIUM NEEDLES

	Well 3 or More Years		Well 5 or More Years	
	No. treated 1930–1946	Well	No. treated 1930–1944	Well
Cheek	98	43—43.8%	76	34—44.7%
Tongue	68	23—33.8%	52	12—23.0%
Alveolus	21	12—57.1%	19	11—57.8%
Floor of mouth	14	8—57.1%	11	5—45.4%
Soft palate	8	3—37.5%	6	2—33.3%
Hard palate	9	4—44.4%	7	3—45.4%
	218	93—47.2%	171	68—40.0%

have been done as many as three times during the seven days of treatment. Good results have been obtained in many such cases and it has occurred to me that the shifting of the radioactive sources may be desirable since it changes the locations of the "hot spots" in the tumors.

The results obtained in 218 consecutive cases treated completely with radium needles are given in Table III. The term "completely" is used advisedly because the metastatic nodes observed in more than one-third of these patients (Table IV) were also treated with radium needles plus roentgen therapy. Although the five year salvage amounted to only 40 per cent in this entire group, complete healing of the primary lesion was obtained in 63.7 per cent, as shown in Table V. Some have expressed the belief that cures can be expected with interstitial irradiation only when the intra-

Table IV

INCIDENCE OF METASTATIC CERVICAL LYMPH NODES IN INTRA-ORAL CANCER

	Total Number of Cases	Cases with Nodes at First Visit	Cases with Nodes Observed Later
Cheek	98	24	5
Tongue	68	25	15
Alveolus	21	3	2
Floor of mouth	14	2	3
Soft palate	8	3	0
Hard palate	9	0	0
	218	57	25

Table V

INTRA-ORAL CANCER TREATED WITH RADIUM NEEDLES

Region	Number of Cases	Primary Lesion Healed
Cheek	98	61—62.2%
Tongue	68	38—55.8%
Alveolus	21	17—80.3%
Floor of mouth	14	10—80.3%
Soft palate	8	7—87.5%
Hard palate	9	6—66.6%
	218	139—63.7%

Table VI

NINETY-THREE CASES WITH INTRA-ORAL CANCER WELL THREE OR MORE YEARS

	Largest Diameter of Primary Lesion		
	Less than 2.0 cm.	2.0 cm. to 3.0 cm.	3.0 cm. or or more
	Cases	Cases	Cases
Cheek	11	13	19
Tongue	4	6	6
Alveolus	2	5	5
Floor of mouth	4	2	2
Soft palate	1	1	1
Hard palate	1	0	3
	23	34	36

oral tumors are of small size and that a good salvage rate is obtained only when most of the lesions treated are small. Table VI was prepared to show that more than two-thirds of the 93 tumors which remained well for three or more years measured 2.0 cm. or more in diameter and more than one-third of the group measured 3.0 cm. or more in diameter.

Space does not permit a discussion of the technical details which enter into the proper implantation of each portion of the mouth. However, some comment seems indicated on the high rate of healing (80.3 per cent) obtained with carcinomas involving the tissues overlying the alveolar processes. Most lesions of this sort were treated with small 0.66 mg. needles inserted vertically in two rows, one on the inner and the other on the outer side of the alveolus. Contrary to general belief, the close apposition of the small heavily filtered sources to bone did not invariably produce devitalization and bone necrosis although superficial layers of bone did slough away before healing occurred in a few cases. A similar experience with cancer of the hard palate indicates that low intensity needles can be used near bone with a minimum amount of damage. As a rule, no attempt is made to irradiate lesions which have actually invaded bone but the series of events illustrated in Figure 13 show the complete eradication of one such lesion. This case suggests that a successful technique might be evolved for the care of local bone invasion.

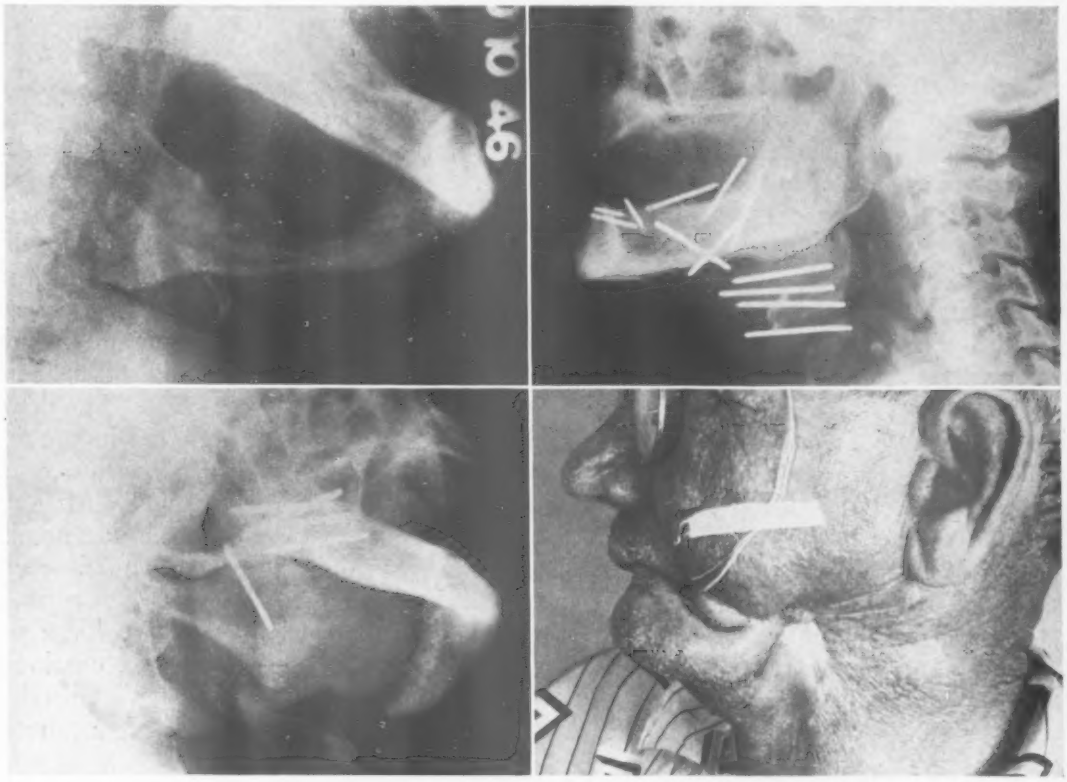

FIG. 13. Large squamous cell carcinoma, Grade 2, of lower left alveolus with bone invasion, well two and a half years after radium needle therapy followed by sloughing of the central portion of the mandible. The lower photographs were made during treatment of a new lesion on the soft palate.

METASTATIC CERVICAL LYMPH NODES

The complete care of patients with cancer of the head and neck must include the treat-

ment of metastatic cervical nodes. Although most surgeons feel that block dissection offers the only chance of cure, the operation has not yielded a high five year cure rate even in selected early cases. Many radiologists have advocated various types of external irradiation but this method has produced no lasting results in our hands except in a few cases secondary to transitional cell carcinoma of the pharynx. In 1931 Quick[36] advocated the use of radon implants in individual nodes as an effective procedure to be used after the external administration of roentgen radiation to the cervical region. He adopted the combined method because Quimby and Pack[40] had shown that larger doses could be used with safety in this manner than with either roentgen rays or radium alone. It was his belief that cervical lymph nodes perform a conservative function and hence should not be disturbed, particularly in the presence of an active primary growth. Later in 1931 Martin and Sharp[28] described a further experience with this technique and stated: "After several years' experience with block dissection of the neck we believe that implantation with gold seeds offers equally good end results in operable cases without the operative risk of the major surgical procedure." In 1935 Quick[37] again published a review of his method and said that it was indicated in all cases except the Grade 4 group unless the case fell in the limited group for surgical dissection or was extremely advanced. In 1940 Martin, Munster and Sugarbaker[26] described this technique in detail. External roentgen radiation is given through small circular ports (3 to 5 cm. in diameter) applied to each separate node and, depending on the size of the port, 4,000 to 8,000 r is given in daily divided doses over a period of two to three weeks. Immediately on the completion of this external dose, radon seeds in a tissue dose of 5 to 10 skin erythema doses are implanted either through puncture wounds in the skin or after surgical exposure of the outer surface of the node.

The work of Quick, Martin and their collaborators indicated that the large doses needed to control metastatic epidermoid carcinoma in cervical nodes could rarely be given safely except with a combination of external and interstitial radiation. The weakness in their technique seemed to lie in the small areas covered and in the poor distribution of radon seeds shown in roentgenograms of implanted regions. It occurred to me that a better distribution of the irradiation over large areas could be obtained with low intensity radium needles which, because they emit only gamma rays, should provide an even higher factor of safety. Since it is not desirable to implant needles through skin which has been heavily irradiated it seemed best to start the roentgen therapy after the needles were in place. In most locations it was found possible to set up a planar implantation extending along the lymphatic bed well beyond the involved nodes. Heavily filtered daily doses of 350 r were then given over the needled region with 220 kv. roentgen rays until a total of 2,100 r had been given. The details of this technique are included in previous articles.[18,19,20] The roentgen-ray dosage was less than that used by Quick and Hayes Martin because it was given simultaneously with the radium therapy. The first case receiving this plan of therapy was treated in 1935. The patient had two large submental glands secondary to a carcinoma of the lip. An excellent result was obtained and the patient is still well after fourteen years of observation.

In 1937 we adopted the policy of treating all metastatic cervical lymph nodes in patients with proved primary epidermoid carcinoma of the face, neck and mouth with this new technique. Since that date, 287 cases have received this type of therapy and 146 were treated prior to March, 1944 (Table VII). No block dissections were done for any of these patients. Of this group 40, or 27.3 per cent, have remained well for five or more years; 91 are known to be dead; and 15 are untraced. Most of the cases were followed for at least a few months, and our most interesting observation was the fact that in 102, or 70 per cent, of the

Fig. 14. Metastatic cervical lymph nodes. *Upper.* Metastatic cervical nodes shown to contain squamous cell carcinoma by excision of a node, well six years after combined radium needle and roentgen therapy. *Middle.* Fixed hard nodes containing cheesy material appearing after cure of a squamous cell carcinoma of the lower lip, well seven and a half years after combined radium needle and roentgen therapy. *Lower.* Squamous cell carcinoma in large node of undetermined origin proved by needle biopsy, well six years after combined radium needle and roentgen therapy.

TABLE VII

ALL PATIENTS WITH METASTATIC CERVICAL NODES TREATED WITH IRRADIATION 1937–1944

Primary Lesion	Number of Cases	Living and Well—Years							Well Five or More Years
		11	10	9	8	7	6	5	
Lip	50		2	4	1	1		6	14
Internal cheek	26		1				2	3	6
Tongue	27			1			1	2	4
Face and neck	20		1				2	3	6
Floor of mouth	3	1				1			2
Ear	4		1					1	2
Alveolus	4							1	1
Undetermined	6					1	3		4
Soft palate	3							1	1
Tonsil and pharynx	3								0
	146	1	5	5	1	3	8	17	40—27.3%

146 cases the palpable glands disappeared. Since many of these cases were far advanced we feel that this is a creditable result. Certainly it compares very favorably with the five year cure rate of 26 per cent reported by Hayes Martin[25] for a group of 65 selected cases treated by block dissection.

In old age groups five year statistics do not always reflect the true worth of a method. This is borne out in a study of the cause of death in the 91 cases that did not survive for five years. Only 46 of these patients died of the cancer treated. The causes of the fatal outcome listed for the other 45 are tabulated in Table VIII. Since many of these cases had obtained complete remissions of the primary lesions and the cervical nodes some might have survived for five years except for the intercurrent disease.

TABLE VIII

METASTATIC LYMPH NODE CASES TREATED FIVE OR MORE YEARS AGO KNOWN TO BE DEAD

Total number of cases	91
Dead of cancer treated	46
Dead of other causes	45

Unknown cause	9	Cancer of larynx	1
Heart disease	2	Cancer of colon	1
Cerebral hemorrhage	3	Metastases:	
Nephritis	2	pulmonary	10
Pneumonia	4	liver	1
Cirrhosis of liver	1	bone	4
Cancer of prostate	1	brain	4

Our work has been criticized repeatedly because no biopsy studies were made on the enlarged nodes in most of the cases reported. It is our contention that those of us who have worked with cancer of the head and neck for many years make few mistakes in the clinical diagnosis of well developed metastatic lymph nodes appearing in patients with proved primary lesions. In many of our cases the nodes became palpable after the primary cancers had healed. Rapid extensions seen in necks from which single nodes had been removed surgically have made us hesitant to advise such a procedure for diagnostic purposes. Needle biopsy is a safer method which has been adopted during the past few years.

As an answer to certain surgeons who have stated that no metastatic cervical lymph nodes proved to contain squamous cell carcinoma have ever been cured with irradiation alone Table IX was prepared. In this group of 17 cases treated five or more years ago some of the diagnoses were made by needle biopsies and others by the removal of single nodes. It is now possible for us to state that 9 proved cases have been

TABLE IX

METASTATIC HISTOPATHOLOGICALLY PROVED SQUAMOUS CELL CARCINOMA IN CERVICAL LYMPH NODES TREATED BY IRRADIATION

Primary Lesion	Number of Cases	Living and Well—Years					Well Five or More Years
		10	9	7	6	5	
Lip	11		1	1		2	4
Face	2	1					1
Undetermined	4			1	3		4
	17	1	1	2	3	2	9

cured by our technique alone. Although most of the nodes were relatively small in these patients, one had a mass in the neck measuring 6.5 by 4.0 cm.; another had a cervical node measuring 3.5 cm. in diameter, and a third had multiple nodes in both submental and the left cervical region. These 9 cases together with the 46 reported by Hayes Martin[25] in 1941 offer positive proof that metastatic cervical lymph nodes containing proved squamous cell carcinoma can be cured by a combination of interstitial radioactive sources and roentgen therapy.

Many seem to share the opinion of Donlan[8] who states that "the fibrosis and scarring produced by interstitial radium needles causes excruciating pain in the neck." With the technique advocated in this paper no such complication has been observed. When large sections of the neck are treated the overlying skin does even-

TABLE X

ADVANCED CANCER OF CERVIX

Lesions	Other Treatment	Radium	Roentgen Rays	Results
4 cm. cervical stump; left parametrium	Subtotal hysterectomy 20 years ago	Weak needles, cervix —left parametrium	2×1,200 r, left with radium	Well 10 years
Entire cervix; left parametrium; vaginal wall	Left nephrectomy at 9 months	Weak needles, all lesions	2×1,260 r, left with radium	Well 6½ years
Cervical stump: left parametrium	Subtotal hysterectomy years ago	Weak needles, both lesions		Well 5 years and 7 months
Large cervix; both parametria	Subtotal hysterectomy 3 months ago	Weak needles—1,200 mg-hr.; capsules in cervical canal		Well 5 years
Cervical stump; vaginal walls	Subtotal hysterectomy 7 years ago	Weak needles—1,050 mg-hr.; capsules in cervical canal		Well 3 years
Cervical stump; both parametria	Subtotal hysterectomy 7 months ago	Weak needles, all lesions		Well 3 years
Entire cervix; both parametria		Weak needles—4,200 mg-hr.; capsules in cervical canal	4×1,200 r, 2, 7 and 12 mo. after radium	Well 2 years

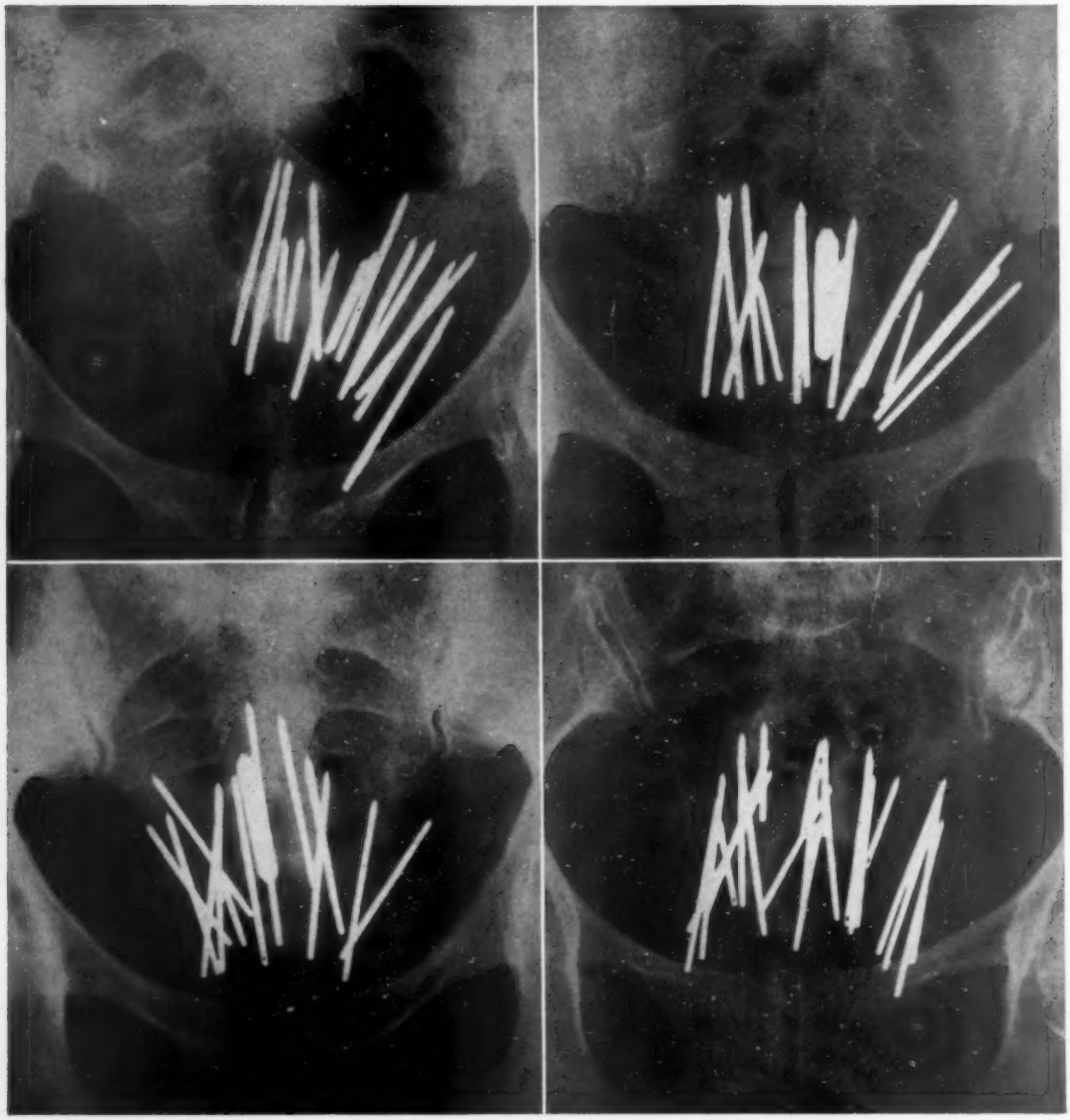

Fig. 15. Radium needle patterns used in 4 cases of carcinoma of the cervix with parametrial extension all of which showed marked improvement with no troublesome sequelae.

tually show some atrophy and a freckled appearance and telangiectases may eventually appear in the scar, particularly in the lower cervical region. It is also true that some subcutaneous fibrosis appears in the larger areas. This complication produces some stiffness and may be accompanied by the same mild discomfort with sudden changes in the weather observed with other large scars. In a few cases small superficial ulcers have appeared in the skin five or six years after treatment, usually following trauma. They have been easily controlled by surgical removal. None of these reactions have produced severe pain and they may be looked upon as relatively unimportant in patients cured of metastatic cervical lymph nodes.

CANCER OF THE FEMALE PELVIS

The value of low intensity radium needles, particularly the longer ones, in the treatment of cancer of the uterine cervix has been emphasized by Pitts and Waterman,[35]

who began using them routinely in 1926 and reported an absolute five year survival rate of 32.6 per cent of a series of 135 cases treated prior to 1933. Their technique was patterned after that of Barris and Donaldson[2] who were especially interested in the use of needles to extend efficient irradiation into the parametrial regions. In a recent article Corscaden, Gusberg and Donlan[5] have shown that as much as 10,000 gamma roentgens may safely be delivered to the outer portions of the parametrium with long needles implanted into this region through the vagina and a diagram published by the author[21] has confirmed these calculations. Pitts and Waterman usually augment their needle implantations by a long intracervical capsule containing 20 mg. of radium and all of the radium containers are left in place for seven days. They also use rather large additional doses of roentgen rays in some cases but I believe this practice to be hazardous. In our own Clinic our longer needles are used in all cases with parametrial involvement and the addition of moderate doses of roentgen rays has proved advantageous. Cervical stump cases are also treated in this manner and the technique has been most useful in treating the residual masses left by poorly trained surgeons who now too often attempt to operate on inoperable lesions. The number of these patients has unfortunately shown a decided increase since so many articles advocating a revival of the Wertheim operation have appeared in the literature.

A few of our encouraging results are shown in Table x. In 1926 Martin and Rogers[23] demonstrated the serious damage which could be produced by high intensity steel radium needles planted in close proximity to the ureters. However, some of our clinical results indicate that low intensity needles placed in the parametria not only do not damage the ureters but may actually restore their normal function by melting down malignant masses which are producing obstruction. Since primary carcinomas of the vaginal wall and secondary implants in these regions tend to grow in layers they can be efficiently treated with these needles which do not produce irreparable injury to the mucosa of either the rectum or the bladder.

MALIGNANT TUMORS IN OTHER LOCATIONS

Many other accessible malignant tumors are suitable for treatment with low intensity radium needles but only the lesions most frequently encountered have been discussed in this paper. Those who are interested should consult the early work of Keynes[14] on cancer of the breast and Gordon-Watson[12] on cancer of the rectum as well as the more recent books by Cade and by Paterson. Lenz, Cahill and Melicow[16] have published an excellent review of a series of cases of cancer of the bladder implanted after cystostomy. Our own files contain records of patients successfully treated for cancer of the bladder, prostate, breast, anus, urethra and vulva. Suffice it to say that I believe that low intensity radium needles constitute an economical, highly efficient addition to the armamentarium of the radiotherapist who strives for a cure and wishes to obtain the best possible results with the minimum of danger to both himself and his patients.

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Vol. 62, No. 4

TRACHEO-ESOPHAGEAL CONSTRICTION PRODUCED BY RIGHT AORTIC ARCH AND LEFT LIGAMENTUM ARTERIOSUM*

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IN 1946 two papers[2,3] from The Children's Hospital of Boston presented a working classification of anomalies of the great vessels at the base of the heart. In these and more recent papers little attention has been devoted to the course or importance of the ductus Botalli. This structure when in association with an aorta which is abnormal in course and position may well produce symptoms.

Partial Classification of Aortic Arch Anomalies

Right aortic arch without visceral inversion.

1. Anterior type—arch is anterior to trachea, descending on the right.
   a. Associated with right ductus Botalli.
   b. Associated with left ductus Botalli.
2. Posterior type—arch passes to the left behind the esophagus and descends on the left or just to the right of its normal left sided position.
   a. This may be associated with a persistent left aortic diverticulum giving origin to the left subclavian and ductus Botalli.
   b. The left subclavian may arise from the right arch and pass behind the esophagus.
3. Left aortic arch descending on the right (Paul).[4]
   a. Associated with right ductus Botalli (Edwards).[1]
   b. Associated with left ductus Botalli.

Recently we have had the opportunity to observe 5 patients with symptoms of constriction of both the trachea and esophagus produced by a vascular ring consisting of a right aortic arch and right descending aorta and a ligamentum arteriosum passing from the pulmonary artery to the left of the trachea and esophagus and then behind the esophagus to join the thoracic aorta on the right side just below the level of the aortic arch. It is probably true, as Edwards[1] has stated, that the ductus arteriosus or ligamentum arteriosum lies on the same side as the upper portion of the descending aorta, and if that is the case in most instances of right aortic arch with the thoracic aorta descending on the right, the ductus Botalli is also on the right and embryologically is a part of the right sixth arch rather than the normal left sixth arch. However, this is evidently not always the case and the important exceptions are those which will produce symptoms.

Previously we have reported[2,3] the case of a patient with a right aortic arch descending on the left and left aortic diverticulum producing a posterior indentation on the esophagus and into this diverticulum was inserted the ductus Botalli which evidently arose on the left side. The diagnosis was not made during the life of the patient. The 5 patients to be presented here were with one exception subjected to film and roentgenoscopic examination of the chest with barium swallow, instillation of lipiodol into the trachea and angiocardiography. One patient under a mistaken diagnosis of double aortic arch was operated upon without angiocardiography. In the other patients the roentgen diagnosis was confirmed by surgical exploration by Dr. Robert E. Gross.

This complex of anomalies may produce, if sufficiently constrictive, signs and symptoms indistinguishable from those produced by any constricting ring of the trachea and the esophagus, perhaps most typically seen in the double aortic arch. Wheezing and stridor have been a prominent feature, and several have shown repeated episodes of

* From the Department of Roentgenology, The Infants' and The Children's Hospitals and the Department of Radiology, Harvard Medical School, Boston, Massachusetts. Presented at the Forty-ninth Annual Meeting, American Roentgen Ray Society, Chicago, Ill., Sept. 14–17, 1948.

respiratory infection and pneumonia. All patients showed a considerable degree of dysphagia, particularly those taking solid foods. Head retraction and increase in the severity of the wheezing and stridor were also evident in the patients in the infant age group. In all of the patients the severity of the symptoms warranted surgical exploration for relief of the vascular ring.

uted to the aortic arch itself, but all patients showed on the posterior aspect of the esophagus at or just below the level of the aortic arch an extrinsic filling defect usually appearing about 0.5 to 1.0 cm. in size. No abnormal pulsation at this defect could be seen. At the same level the left side of the esophagus usually showed a very shallow and barely detectable filling

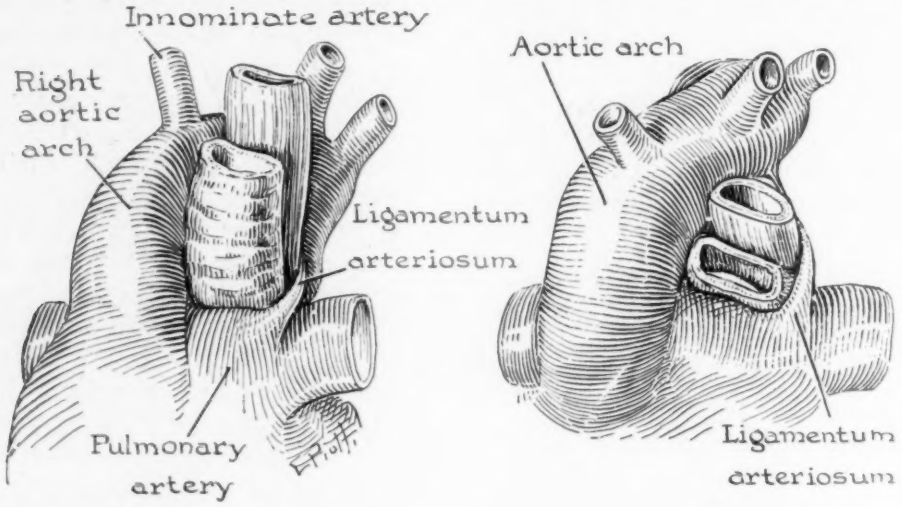

Fig. 1. (*A*) A drawing made in the left anterior oblique projection shows the relationship of the right aortic arch and the ligamentum arteriosum producing a constricting vascular ring. (*B*) When viewed from above the constriction of the trachea and esophagus produced by the aorta and ligamentum arteriosum is evident.

The roentgen findings were very similar in all cases and although they resembled strikingly the roentgen changes observed in patients with double aortic arch, close analysis of the findings enables one to make the correct diagnosis, particularly if angiocardiography is done for confirmation. Simple roentgenoscopy without contrast medium showed that the major mass of the aorta and aortic arch was on the right side of the midline. After barium swallow and observation of the course and contour of the barium-filled esophagus, it was evident that the right aortic arch produced a shallow but definite indentation on the right side of the esophagus which could be best seen in the anteroposterior projection and in the left anterior oblique view. In none of the 5 patients could a posterior defect of the esophagus be seen that could be attributed to the aortic arch itself, but all patients showed on the posterior aspect of the esophagus at or just below the level of the aortic arch an extrinsic filling defect usually appearing about 0.5 to 1.0 cm. in size. No abnormal pulsation at this defect could be seen. At the same level the left side of the esophagus usually showed a very shallow and barely detectable filling defect. After the instillation of the lipiodol into the trachea in the anteroposterior projection a definite rather prominent defect on the right side of the trachea could be visualized in all of these patients. No defect on the left side of the trachea could be seen and no definite narrowing of the trachea in the lateral projection could be identified, although this was suspected in several of the patients.

In 4 of the patients the correct diagnosis of the intrathoracic vascular anomaly was made from these findings, but before surgical exploration was carried out it was deemed wise to inject 70 per cent diodrast to obtain serial films of the heart and great vessels to visualize more clearly the exact anatomical arrangement of the aorta and of its intrathoracic branches. The angiocardiograms exhibited clearly the course of

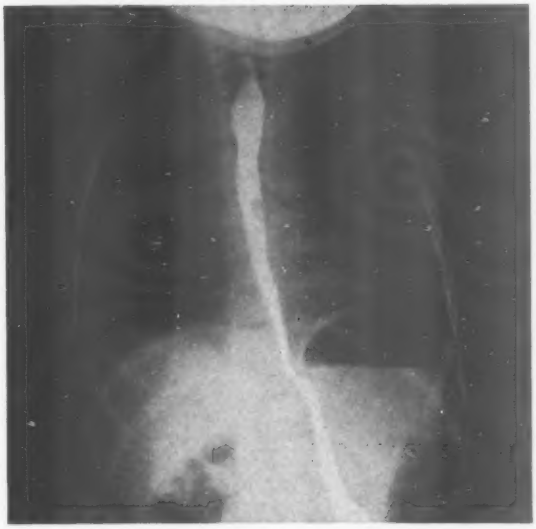

Fig. 2. Case 1. P. LaC., white male, aged three years, with symptoms of severe stridor and dysphagia dating from shortly after birth, three episodes of pneumonia. In the anteroposterior projection the main mass of the aorta is seen to the right of the midline producing a shallow indentation on the right side of the barium-filled esophagus. A similar but smaller and less marked indentation is seen on the left at the same level.

Fig. 3. Case 1. The posterior defect which appears long and shallow is evidently produced by the ligamentum arteriosum. A small portion of the aortic arch may project posterior to the esophagus.

Fig. 4. Case 1. After instillation of lipiodol into the trachea a shallow defect is seen on the right side of the trachea at the level of the aortic arch. The defect is evidently produced by the right-sided aortic arch.

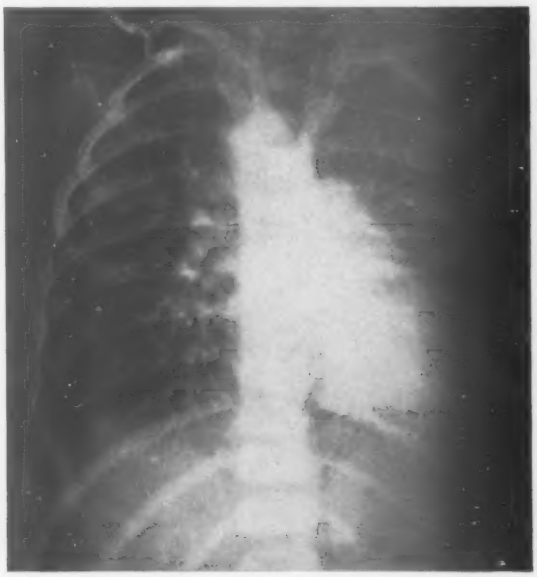

Fig. 5. Case 1. Angiocardiogram depicts the right aortic arch and right descending aorta. The first branch from the aorta is a left innominate. The right common carotid arises as the second vessel and a right subclavian as the third.

Fig. 6. Case II. S. McC., white female, aged ten, who exhibited severe stridor dating from birth and exertional dyspnea; no important dysphagia. In the anteroposterior projection the right aortic arch descending on the right is well seen. This produces a large rounded filling defect on the right side of the barium-filled esophagus. A considerably smaller shallow defect is seen at the same level on the left side.

Fig 7. Case II. A film made with lipiodol both in the trachea and esophagus shows a shallow posterior defect in the esophagus at the level of the aortic arch and very minimal narrowing of the trachea at the same level.

Fig. 8. Case II. In the anteroposterior projection the prominent defect on the right side of the trachea can be seen. There appears to be a slight deviation of the trachea to the left at this level.

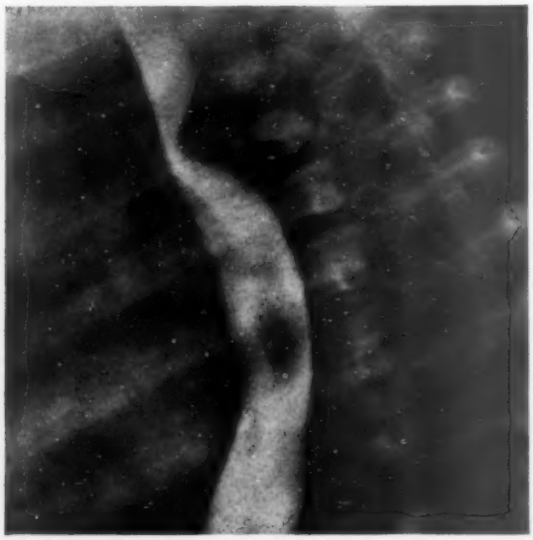

Fig. 9. Case III. R. B., white male infant, severe stridor and dysphagia dating from birth. In this patient the defect on the posterolateral aspect of the barium-filled esophagus appears to be quite large, but at operation it was found to be produced by the ligamentum arteriosum alone. The aortic arch was entirely on the right side and the aorta descended on the right.

the aorta with the arch on the right side and the thoracic aorta descending on the right. In 2 patients in which this procedure was done there was reversal of the aortic arch branches so that the innominate artery arose as the first branch and divided into a left subclavian and left common carotid, while on the right the two vessels emerged from the aortic arch separately. Naturally no visualization of the ductus Botalli was obtained, as in each patient this structure was closed.

Only 1 patient showed a cardiac anomaly that could be recognized. This patient was cyanotic, presented a soft systolic murmur and showed a right axis deviation on the electrocardiogram and was thought to have a tetralogy of Fallot. In addition, the patient had an anomaly of the tracheobronchial tree in that the right upper lobe bronchus arose separately from the trachea about 1 cm. above the bifurcation. This anomaly is of considerable significance in a patient with a right aortic arch as the aortic arch courses above this anomalous bronchus and we have seen several patients in whom this anomaly produced alternating atelectasis and obstructive emphysema of the right upper lobe. However, at the time of examination no evidence of pressure from the aorta on the anomalous right upper lobe bronchus could be detected.

Fig. 10. Case III. After instillation of lipiodol into the trachea an appearance essentially similar to the previous patient is seen—a shallow defect on the right side of the trachea at the level of the aortic arch. The major mass of the aorta is seen on the right. The patient evidently has an engorged azygos vein which can be seen to the right of the spine.

Fig. 11. Case IV. M. K., white female infant, with stridor and dysphagia dating from birth, shows on barium swallow the mass of the aorta to be on the right and a shallow defect on both the right and left sides of the esophagus at the level of the aortic arch. The defect on the left side is lower in position and is evidently produced by the ligamentum arteriosum.

It is probable that the anomaly of a right aortic arch descending on the right with a vascular ring produced by the ductus Botalli is relatively uncommon. Undoubtedly in many patients the vascular ring is not sufficiently severe either to produce symptoms, or, if present, symptoms insufficient to warrant surgical exploration with division of the ligament. Probably other similar or closely related anomalies exist only to await recognition during life. Paul[4] has reported on patients with a left aortic arch with the thoracic aorta descending on the right side. Edwards[1] has seen at autopsy a patient with right ligamentum arteriosum which evidently produced some constriction.

Fig. 12. Case IV. In the right anterior oblique projection a deep notch in the posterolateral aspect of the esophagus is seen. This defect at operation was found to be due entirely to the ligamentum arteriosum.

Fig. 13. Case V. K. V., white female, aged two, with cyanosis, dyspnea, stridor and dysphagia dating from birth. In the right anterior oblique projection a rounded defect is seen on the posterolateral aspect of the esophagus, evidently produced by the ductus Botalli. A shallow defect could be seen on the right side of the esophagus produced by the right aortic arch.

If the condition is kept in mind the differential diagnosis should not be too difficult if a thorough and complete examination is done, and we do not believe that angiocardiography is necessary to establish the correct roentgen diagnosis. The anomaly most apt to be confused with this picture is that of the double aortic arch, particularly when the posterior or right arch passing behind the esophagus is the smaller of the two. All of the patients with double aortic

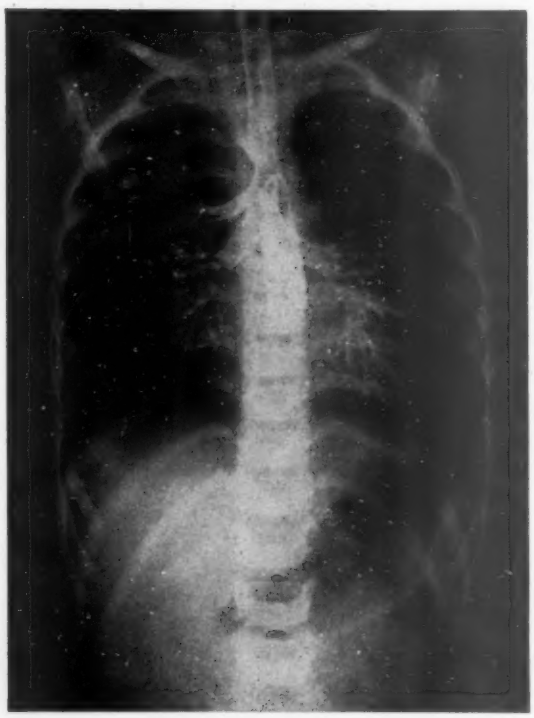

Fig. 14. Case V. Following the instillation of lipiodol into the trachea an anomalous right upper lobe bronchus arising from the trachea above the bifurcation is seen. The aortic mass is on the right and there is a shallow defect on the right side of the trachea at the level of the aorta. A diagnosis of tetralogy of Fallot with vascular ring produced by a right aortic arch descending on the right and a ligamentum arteriosum on the left was made. As yet operation has not been carried out on this patient.

arch that we have seen have produced a defect both on the right and left sides of the esophagus as well as a definite posterior defect. Similar changes have been noted in the trachea after visualization with lipiodol. None of the patients with double aortic arch, and the roentgen diagnosis has now been made in 18, have exhibited the main vascular mass of the aorta on the right side, but rather did it seem equally divided between the right and left side and on plain roentgenoscopy usually was not a particularly evident structure.

Although we have had no recent example of a right aortic arch with left aortic diverticulum retro-esophageal in position with a ligamentum arteriosum entering the diverticulum, it is probable that the picture produced by this anomaly would even more closely resemble the picture produced by a double aortic arch. However, the exact diagnosis is rarely of great importance as with considerable ease the diagnosis of a constricting ring can be made and if symptoms are sufficiently severe surgical exploration carried out with division of some portion of the ring. It seems likely that one occasionally will find a patient with an anomalous course of the aorta with a patent ductus Botalli. Here the roentgen changes could be identical to those described, but in addition the patient should present the characteristic murmur of a patent ductus arteriosus. The recognition of the position of the ductus in these patients would be of considerable importance to guide the surgeon in his operative approach for section or ligation of the ductus.

SUMMARY

Five patients who exhibited severe stridor and dysphagia are discussed. In these patients the symptoms were due to a right aortic arch with the thoracic aorta descending on the right side and a ligamentum arteriosum arising from the pulmonary artery and passing to the left of the trachea and esophagus and behind the esophagus to the thoracic aorta producing a constrictive ring.

On roentgen examination these patients showed the aortic vascular mass to the right of the midline, an indentation of the barium-filled esophagus seen on the right side of the esophagus in the anteroposterior projection and in the left anterior oblique view, and a small defect on the posterior aspect of the esophagus produced by the ligamentum arteriosum as it passed behind the esophagus from the left side. The trachea showed a shallow extrinsic pressure defect on the right side.

Surgical exploration with division of the ligamentum arteriosum and freeing of the vascular structures was carried out by Dr. Robert E. Gross, evidently with complete relief of stridor and dysphagia. It is believed that these are the first instances of this procedure.

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THE ROENTGENOGRAPHIC AND ANGIOCARDIOGRAPHIC ASPECTS OF (1) ABERRANT INSERTION OF PULMONARY VEINS ASSOCIATED WITH INTERATRIAL SEPTAL DEFECT AND (2) CONGENITAL ARTERIOVENOUS ANEURYSM OF THE LUNG*

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ABERRANT INSERTION OF PULMONARY VEINS ASSOCIATED WITH INTERATRIAL SEPTAL DEFECT

THE increasing need for precise diagnosis in congenital heart disease necessitates an analysis of even rare anomalies. Aberrant insertion of pulmonic veins has been regarded as an anatomic curiosity. Clinical and roentgenographic descriptions of this condition have not been found.

Only recently, Brody[4] reviewed in detail the embryology of the pulmonic veins and described the many variations in insertion. Of the cases in which complete drainage of the pulmonic veins into the right side of the heart occurred (mostly into the coronary sinus), only three are known to have survived infancy. With the drainage of only the veins of one lung to the venous side, however, the rate of survival beyond infancy was much higher. In all of the cases in which both pulmonic veins were abnormal, cardiac symptoms occurred, whereas symptoms rarely occur when only one of the pulmonic veins has an aberrant insertion; hence, these cases are found only at postmortem. However, they have invariably been associated with a particular type of slit-like interatrial septal defect located above and posterior to the fossa ovalis.[2,5,13] In addition, the right atrium and ventricle have usually been found enlarged and hypertrophied, and the pulmonary artery dilated.

White[25] states, "Congenital anomalies of the veins are of little or no clinical importance. . . . The diagnosis of uncomplicated congenital defects of the great veins has not yet been made during life." Indeed the defects compatible with life beyond infancy cause no significant disturbance of the hemodynamics. If, however, they appear as a structure in the roentgenogram of the chest, they require identification and precise analysis. This has been made possible by the proper application of angiocardiographic recordings through the serial exposure technique.[18,19,20,21] In this way a study of the anatomy of these structures and of the sequence of passage of the diodrast opacified blood mixture through the various structures is possible.

We have observed and are reporting 3 cases of aberrant insertion of the right lower lobe pulmonic vein. One case, seen in consultation, presented an aberrant insertion of the right upper lobe vein.

In 2 cases, cardiac murmurs were discovered in early childhood, and the third case was discovered incidental to a routine roentgenographic examination of the chest. Case A. R. (Fig. 2, 3 and 4) revealed systolic and diastolic murmurs over the pulmonic area and to the right of the lower part of the sternum. The other 2 cases had systolic murmurs over the pulmonic area only. The electrocardiogram in all instances showed a partial right bundle branch block which is so very frequently encountered in interatrial septal defect. The roentgenographic findings, identical in all 3 cases, were as follows: Considerable enlargement

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of the heart to the right; moderate enlargement to the left; a considerable prominence of the pulmonary artery segment; and a laterally convex vascular shadow parallel to the lower right cardiac border.

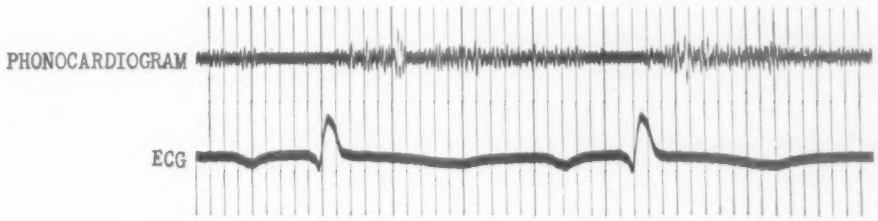

Fig. 1. A systolic and diastolic murmur was recorded to the right of the aortic area in a case of aberrant insertion of a right upper lobe pulmonic vein into the vena cava superior. The character is that of a continuous murmur of an arteriovenous fistula.

Although somewhat atypical in respect to the roentgenographic configuration, the clinical and laboratory findings of our cases are essentially those of uncomplicated interatrial septal defect. The right atrial enlargement in our cases was far greater than that of the right ventricle and pulmonary artery.

Continuous murmurs have been observed with aberrant insertion of pulmonic veins mostly in instances of complete drainage into coronary sinus or venae cavae. It appears difficult, however, to differentiate them from those present when there is an associated interatrial septal defect. In one instance of aberrant insertion of the right upper lobe pulmonic vein, a continuous murmur was audible to the right of the aortic area (Fig. 1). The murmur did not have the characteristics of aortic insufficiency but rather those of an arteriovenous fistula, such as patent ductus arteriosus. In addition the peripheral hemodynamics were not altered.

Roentgenographically aberrant pulmonic veins appear as a laterally convex falciform structure (Fig. 2, 3, 4, 5 and 6). They begin near the center of the respective lobe and extend to the point of insertion which in our 3 cases is the vena cava inferior. They have the homogeneous appearance of a vascular structure without demonstrable disturbance of the surrounding lung fields (infiltration, atelectasis, etc.). Roentgenoscopically, pulsations were not discernible and only suggestive density variations could be elicited by the Valsalva and Müller experiments.

Angiocardiography has proved to be the most useful diagnostic procedure for demonstrating as clearly as possible the abnormal function of the aberrant vessel. The angiocardiograms of Case A. R. in the

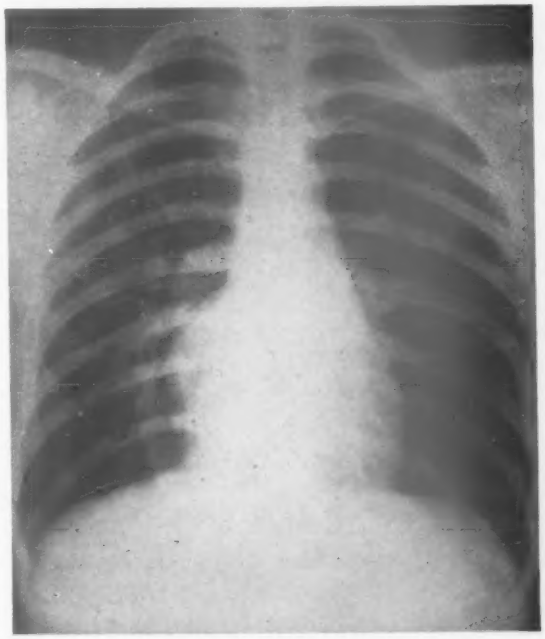

Fig. 2. A. R., male, aged twenty-four. Conventional roentgenogram. Considerable enlargement to the right, moderately prominent pulmonary artery and branches. The aberrant pulmonic vein is seen as a bandlike vascular shadow parallel to the lower right cardiac border (arrow).

posteroanterior and left anterior oblique views illustrate this clearly (Fig. 3 and 4). We found that once the observer is acquainted with the identity of this structure, he will not fail to diagnose it properly in future instances even from the conventional roentgenogram.

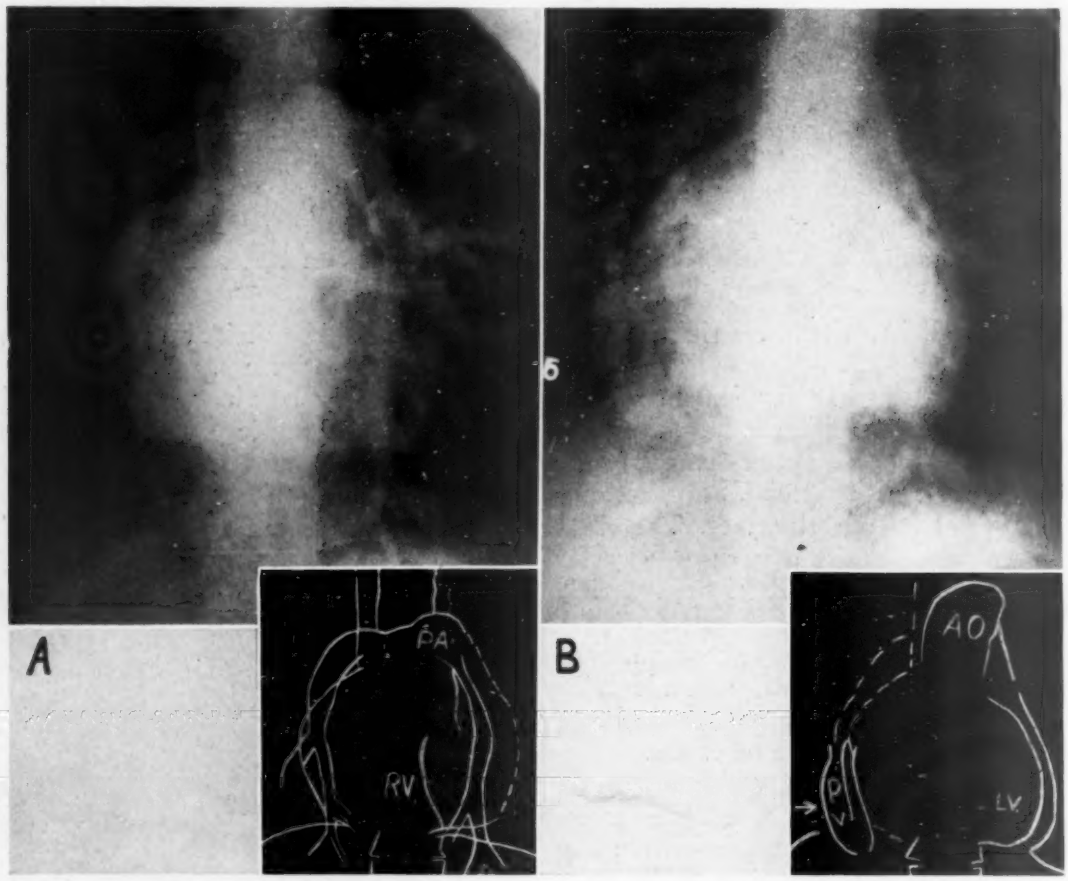

FIG. 3. Angiocardiogram, posteroanterior view. (*A*) One and one-half to two seconds after injection; marked right atrial enlargement pulmonary artery and branches considerably dilated. (*B*) Two seconds later during visualization of left atrium, ventricle and aorta; anomalous vascular shadow at right cardiac border demonstrated.

The aberrant insertion of a pulmonic vein into the right atrium by means of right heart catheterization has also successfully been diagnosed by Dr. J. de F. Baldwin and Dr. A. Cournand *et al.* With the tip of the catheter at a right lateral point of the atrium, an oxygen saturation similar to that of the arterial blood was obtained. However, the differentiation of such a finding from those possible in interatrial septal defect appears difficult and somewhat uncertain. Baldwin, Cournand *et al.* did not mention the presence of a roentgen shadow corresponding to the aberrant pulmonic vein. It is possible that smaller aberrant or accessory pulmonic veins or those in roentgenographically inopportune locations (e.g. behind the heart) might well escape detection. Vascular structures, unless angiocardiography or serial section roentgenography is used, have to be of a certain size and density before becoming roentgenographically demonstrable.

CONGENITAL ARTERIOVENOUS ANEURYSM OF THE LUNG

Clinically, arteriovenous aneurysms of the lung are now a frequently recognized

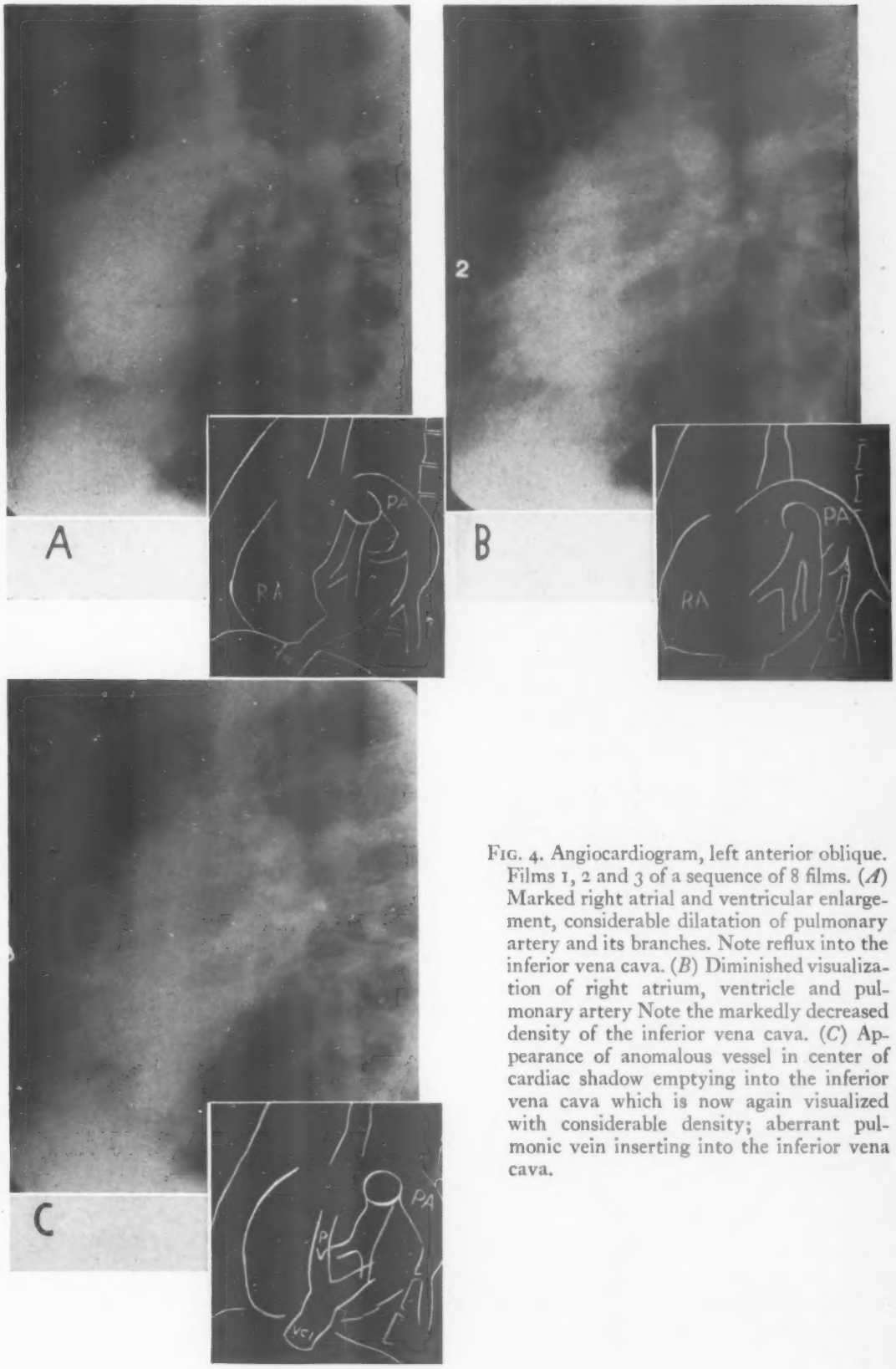

Fig. 4. Angiocardiogram, left anterior oblique. Films 1, 2 and 3 of a sequence of 8 films. (*A*) Marked right atrial and ventricular enlargement, considerable dilatation of pulmonary artery and its branches. Note reflux into the inferior vena cava. (*B*) Diminished visualization of right atrium, ventricle and pulmonary artery Note the markedly decreased density of the inferior vena cava. (*C*) Appearance of anomalous vessel in center of cardiac shadow emptying into the inferior vena cava which is now again visualized with considerable density; aberrant pulmonic vein inserting into the inferior vena cava.

Fig. 5. G. H., male, aged twenty-two. Conventional roentgenogram. The heart is enlarged to the right and left, considerable prominence of pulmonary artery segment. Appearance of aberrant pulmonic vein and angiocardiographic analysis almost identical to Case A. R. (see Fig. 2, 3 and 4).

Fig. 6. H. R., male, aged twenty-six. Conventional roentgenogram. Marked enlargement of the heart to the right, considerable prominence of pulmonary artery, particularly its left main branch. Broad vascular shadow parallel to lower right cardiac border less dense than in Cases A. R. and G. H. (Fig. 2–5). Angiocardiography revealed this shadow to be demonstrated later than the pulmonary artery and communicating with the inferior vena cava.

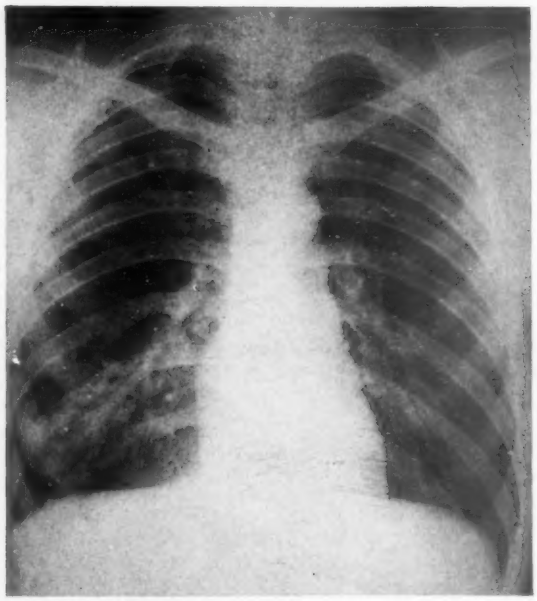

Fig. 7. R. W. G., male, aged twenty-three. Congenital arteriovenous aneurysm of right lower lobe. Cyanosis, clubbing and circulatory insufficiency. Conventional roentgenogram: large coil of vascular structures in right lower lobe apparently in continuity with right lower pulmonary artery and vein.

anomaly. Since they can be cured by lobectomy with complete disappearance of the often severe hemodynamic disturbance, their proper diagnosis is essential. The characteristic clinical features have been repeatedly discussed.[3,6,7,11,12,16] The most commonly encountered signs and findings are cyanosis and clubbing, a pulmonic mass, and occasionally signs of circulatory insufficiency. Transient episodes of sudden unconsciousness, convulsions and transient neurological signs were present in several cases reported[12,17] as well as in one of our cases. Sisson *et al.*[16] reported such an epi-

Fig. 8. Laminagram (8 cm. from anterior chest wall) suggests multichambered large aneurysm (lower arrow) filling via large branch of pulmonic artery and emptying through very wide pulmonic vein, just below and more proximal to the heart. A smaller racemose vascular structure (upper arrow) is suggested above the main aneurysm.

Fig. 9. Angiocardiogram. During visualization of right heart and pulmonary artery a large branch of the latter is seen to fill the vascular coil of the arteriovenous aneurysm; emptying into a dilated pulmonic vein a smaller racemose vascular structure is demonstrated cephalad. At operation an accessory pulmonic vein with aberrant insertion into the vena cava inferior was found in addition.

sode occurring two hours after an injection of diodrast which was introduced through an intracardiac catheter far into the right side of the heart. The outcome of the episode was fatal. They ascribed this to diodrast sensitivity and warned against its use in angiocardiography. The justification of this admonition, which was based on the experience of one single case, is, however, questionable particularly since over 1,500 cases subjected to angiocardiography have been reported without untoward result.[19] It is particularly so since similar episodes have been observed by others to occur spontaneously in these pulmonary arteriovenous aneurysms. These transient complications may be caused by: cerebral

Fig. 10. F. M., female, aged twenty. Congenital arteriovenous aneurysm of right lower lobe. Conventional roentgenogram: Huge well circumscribed round mass in right lower lobe, apparently in continuity with branch of pulmonic artery. Very wide vascular shadow below pulmonic artery (pulmonic vein?). A second one in right cardiophrenic angle (vena cava inferior? Accessory aberrant pulmonic vein?).

Fig. 11. Angiocardiogram. During visualization of right heart and pulmonic artery the right lower branch of the latter is seen to fill a huge aneurysm of the right lower lobe. It empties through an enormously dilated pulmonic vein. Whether the vascular shadow in the right cardiophrenic angle is an accessory pulmonic vein or the vena cava inferior cannot be definitely stated.

anoxemia, cerebral sinus thrombosis, cerebral embolism from a thrombus within the arteriovenous aneurysm, or air embolism.[12]

The 3 patients with pulmonary arteriovenous aneurysm reported here presented cyanosis, clubbing of the digits and symptoms and signs of circulatory insufficiency. Precordial murmurs could be heard in none of them. Lobectomy in Case R. W. G. (Fig. 7, 8 and 9) revealed an aberrant insertion of the right lower lobe pulmonic vein into the vena cava inferior. In the third case (Fig. 12), an accessory pulmonary artery was found entering the apex to the right lower lobe. Marked improvement followed ligation of this vessel, although lobectomy was not performed. The second patient has not yet been operated upon (Fig. 10 and 11).

The roentgenographic appearance of congenital arteriovenous aneurysm of the lung is rather characteristic: A serpiginous racemose cluster, or coil of structures, with parallel walls which suggest vascular structures in density and outline. This is especially true at the medial regions of the shadow where the venous and arterial components resolve themselves. The outlines of the structures are smooth and sharply demarcated except at the actual site of shunt where there is a variable amount of pooling. Pulmonary infiltration is absent but there may be some focal atelectasis. Little change is seen roentgenoscopically during the Valsalva or Müller experiments. Lindgren,[12] however, observed demonstrable changes with both procedures. Angiocardiography is the method of choice to demonstrate that the pulmonary shadow consists of vascular components. During the passage of the radiopaque substance through the heart and large vessels, the sequence of visualization is such that the pulmonary arterial

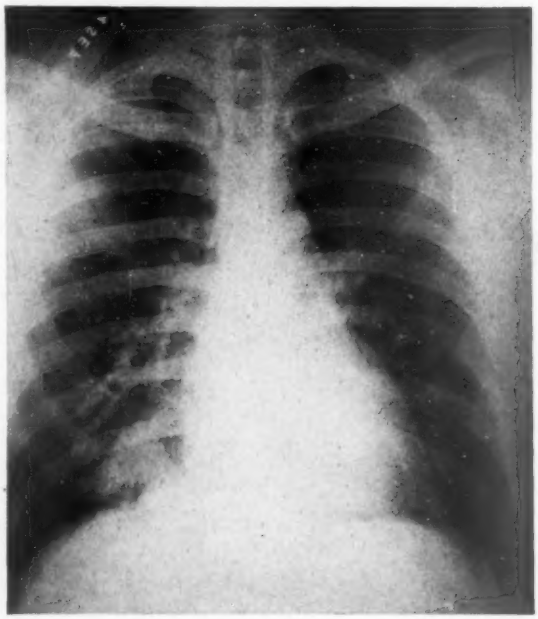

Fig. 12. J. E. M. Congenital arteriovenous aneurysm of right lower lobe. Cyanosis, clubbing, dyspnea, occasional blood expectoration and convulsions. Conventional roentgenogram: Inverted V-shaped vascular shadow of right lower lobe. Operation revealed accessory pulmonic artery leading to aneurysm.

component is seen first and the pulmonic veins later (about two and four seconds after the injection respectively). Serial sectional roentgenography also suggested that the pulmonary shadow was connected to the pulmonic vessels.

One of Lindgren's patients, operated upon by Craaford,[12] was found to have an accessory pulmonic artery deriving from the lobe above and leading to the aneurysm. Our 2 operated patients had an accessory pulmonary artery and aberrant pulmonic vein respectively. Although accessory and aberrant pulmonic vessels are not uncommon[1,8,9,10,15] little mention is made of them in the literature either pertaining to regional anatomy or pulmonary arteriovenous aneurysms.

SUMMARY

1. The roentgenographic appearance and clinical recognition of aberrant insertion of pulmonic veins occurring in cases of interatrial septal defect are presented and discussed.

2. Diagnosis was established by angiocardiography with serial exposure technique.

3. It is suggested that these anomalies can be easily recognized once the observer is acquainted with their existence and roentgenographic appearance. Aside from angiocardiography, right vena caval catheterization should prove helpful in confirming the diagnosis. Right atrial, as well as right ventricular oxygen saturation figures, larger than those of the vena cava superior or inferior, might however just as well be due to the frequently associated interatrial septal defect.

4. In interatrial septal defect, the association with aberrant insertion of one pulmonic vein is compatible with long life. Only in extremely rare instances is the abnormal insertion of more than one into the main tributaries of the right atrium compatible with life beyond infancy. The almost invariably associated interatrial septal defect is above and posterior to the fossa ovalis (overriding vena cava superior).

5. The roentgenographic appearance and diagnosis of congenital pulmonic arteriovenous fistula by means of angiocardiography has been discussed. The apparently frequent occurrence of aberrant and accessory pulmonary arteries and veins has been stressed. This point should be of particular importance to thoracic surgeons undertaking lobectomy for the cure of this anomaly.

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Vol. 62, No. 4

THE TIME FACTOR IN CEREBRAL ANGIOGRAPHY AND AN AUTOMATIC SERIOGRAPH*

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THE TIME FACTOR

INVESTIGATORS who have been interested in the field of cerebral angiography have long ago realized the importance of visualizing the three main different stages in the cerebral circulation.

Egas Moniz,[2,3] as well as ourselves,[6,7] has emphasized upon different occasions the importance of the capillary phase.

Hodes, Perryman and Chamberlain,[4] in their review of cerebral angiography, state that the difficulty in obtaining the capillary phase, or in other words a complete angiogram, is that of rapid and precise changing of the cassettes.

Every complete angiogram is formed by one arterial stage, one capillary stage, and one venous stage. The venous stage is clearly divided in two phases, first and second.[6] Those three stages of cerebral angiography are accomplished in four and one-half seconds, provided no extraneous factors interfere with the circulation.[7]

The time consumed in the injection, the amount of opaque substance and the management of the pressure employed during the injection are of great importance. Too large amounts of opaque substance contribute to interference with the different stages, or with the phases of the venous stage by visualizing too much of the circulatory system of the brain at the same time. The pressure of the injection has a direct effect upon the concentration of the medium and upon the sharp visualization of the vessels.

We may consider the opaque substance as a "liquid segment" which must be followed in its passage through the vascular system of the brain and recorded on films, in the different stages.

Since 1931, we (J. M. S-P.) have injected various amounts of opaque substance and since 1936 have decided that the optimal volume is 6 cc. when the injection is made in the internal carotid artery, while 8 cc. is required in the common carotid artery.

We have found that the most favorable interval between exposures results from obtaining six films in four and one-half seconds, this particular length of time being that required normally for the "liquid segment" to travel from the common carotid artery in the neck to the internal jugular vein in the neck.[5] With those constants, the six roentgenograms taken will provide the component elements of a complete cerebral angiogram from all points of view (Fig. 1).

Very often the circulation in one or in both cerebral hemispheres takes place in less time than that considered normal.[1,5,8] In these cases the blood leaves the brain sooner due to two possibilities: First, a rapid rate of circulation; second, a short-cut shortens the path, decreasing the time required for passage of the "liquid segment" through the cerebral hemisphere (Fig. 2). Serial roentgenograms will prove which has occurred. Very often the rate of circulation is abnormally slow (Fig. 3). In that case, the fifth picture that should correspond to the phlebography of the second phase, still reveals the phlebography of the first phase, or even the arterial stage, as in one case of carotid thrombosis (Fig. 4). In such a case, six roentgenograms still present a complete angiogram of the side injected. The slowing of the circulation can be also of two types. One, in which the vascular pathways have been enlarged, as in certain types of arteriosclerosis, or in

* From the University of Southern California Medical School and the Departments of Neurosurgery and Radiology of the Los Angeles County Hospital. Presented at the Forty-Ninth Annual Meeting, American Roentgen Ray Society, Chicago, Ill., Sept. 14–17, 1948.

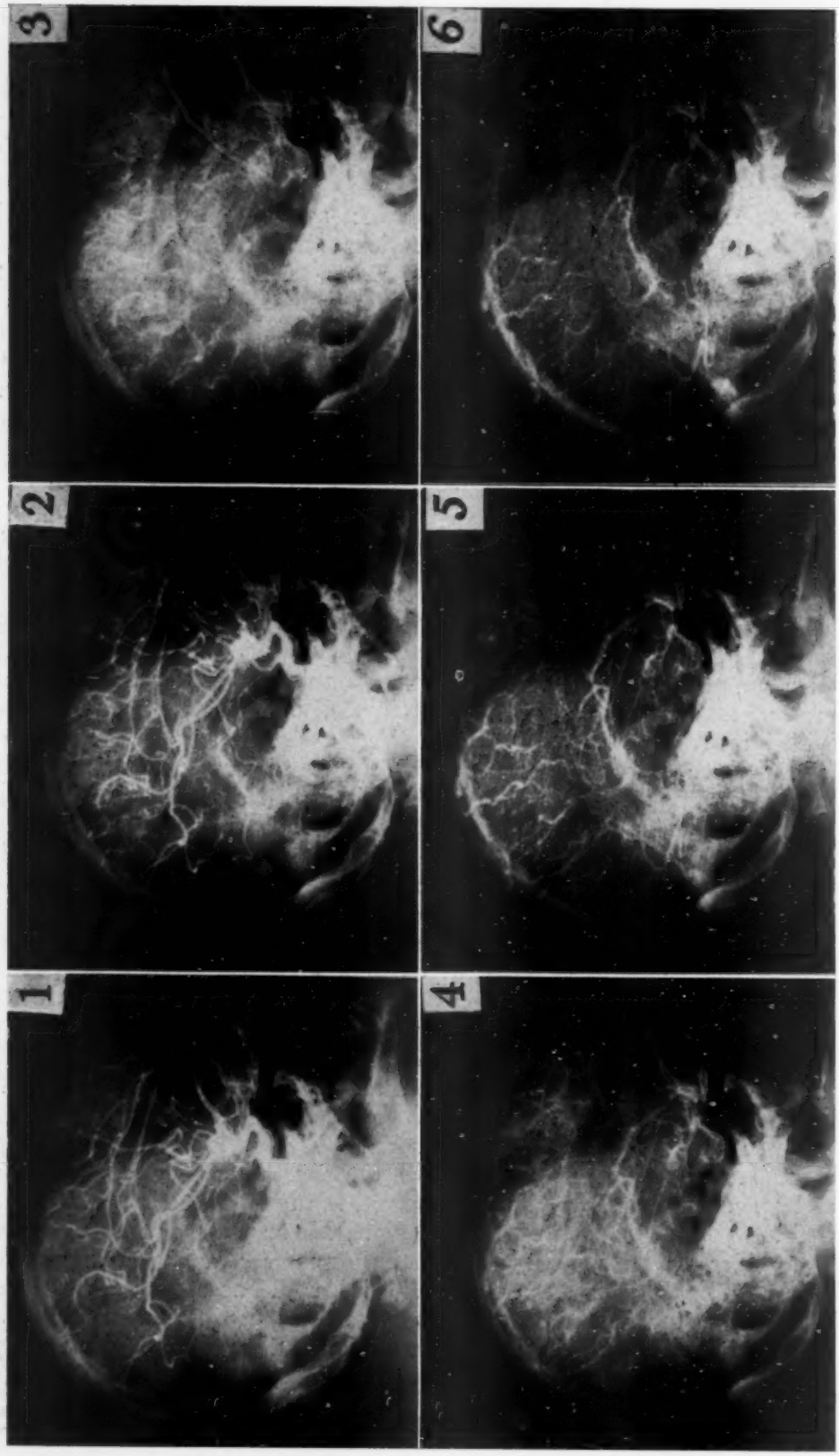

Fig. 1. Complete angiogram, approximately normal.

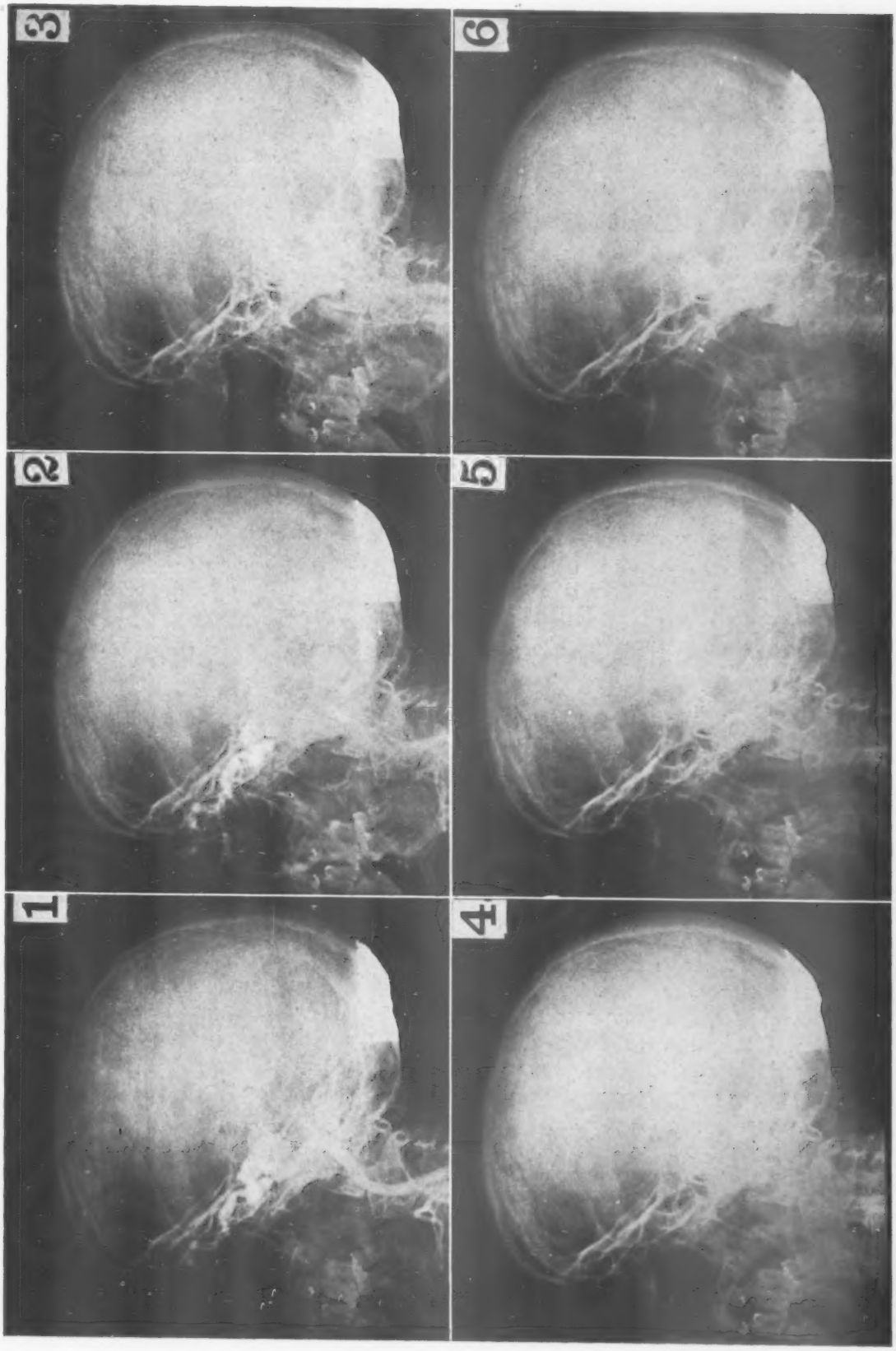

Fig. 2. The opaque medium passes from the carotid artery to the cavernous sinus, and ophthalmic veins, leaving the cranial cavity in 2.5 seconds without increasing the rate of flow.

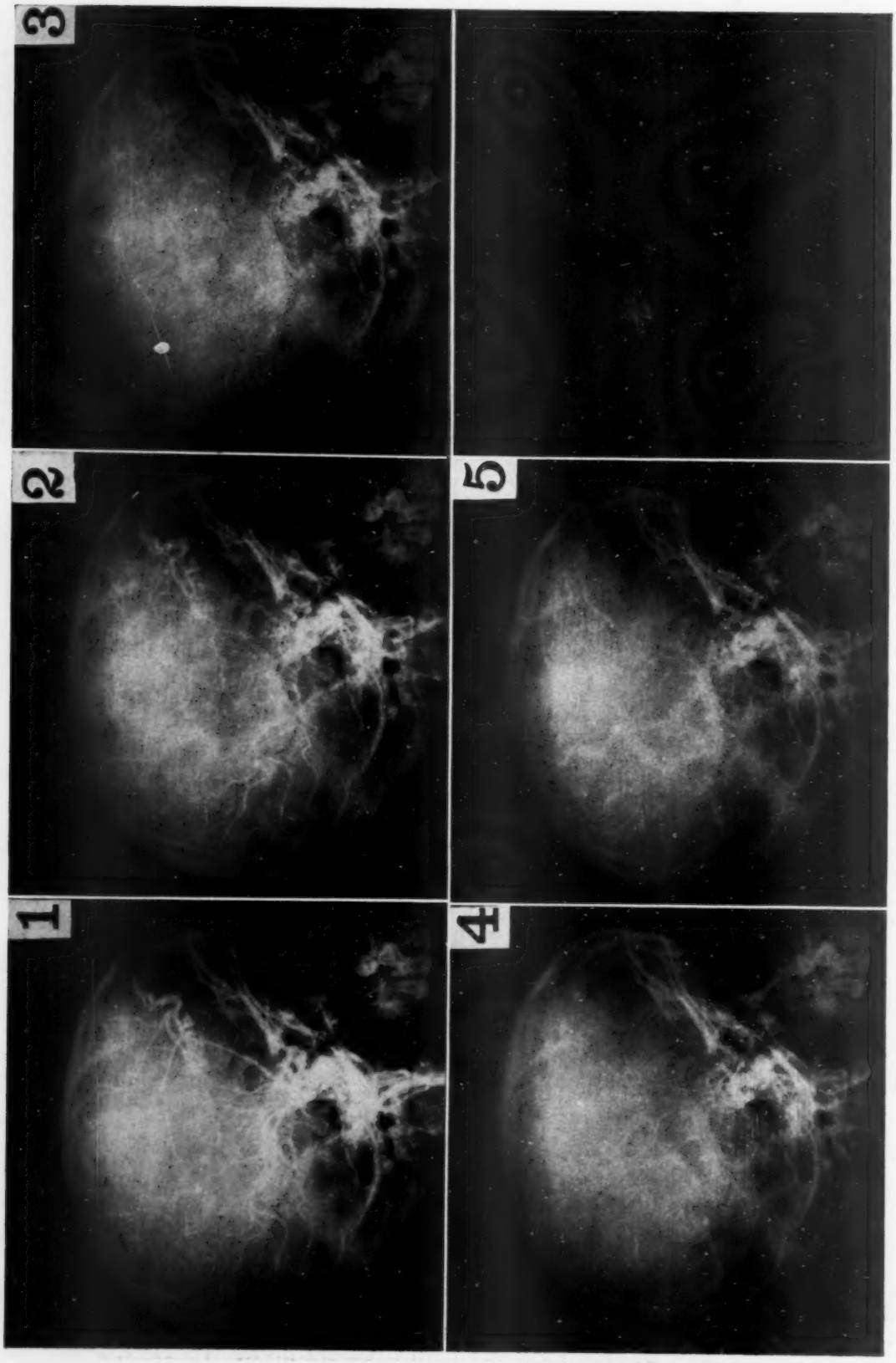

FIG. 3. Complete angiogram in a congenital vascular malformation in the frontal region.

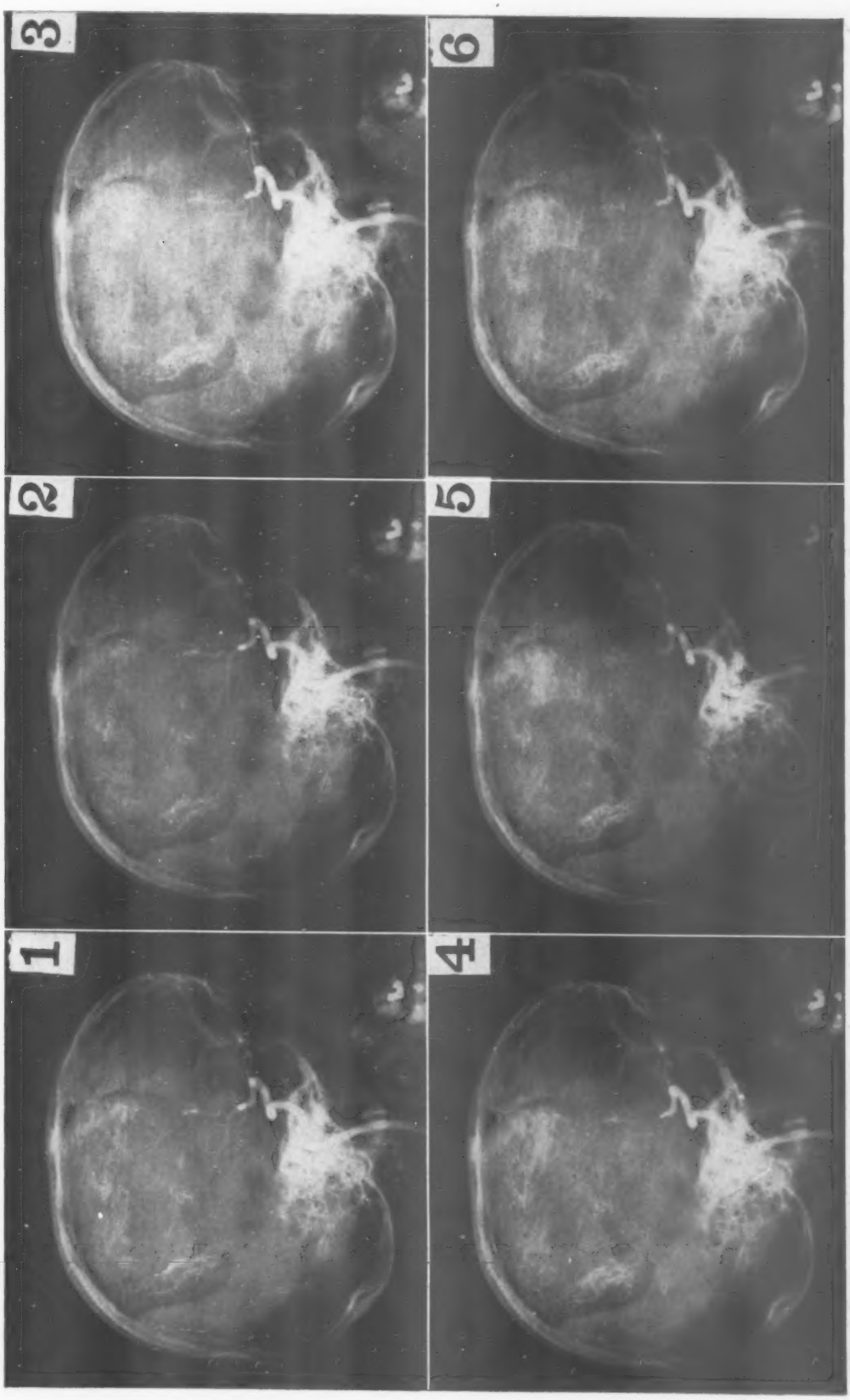

Fig. 4. Internal carotid thrombosis. Opaque substance does not progress in 4.5 seconds of the exploration.

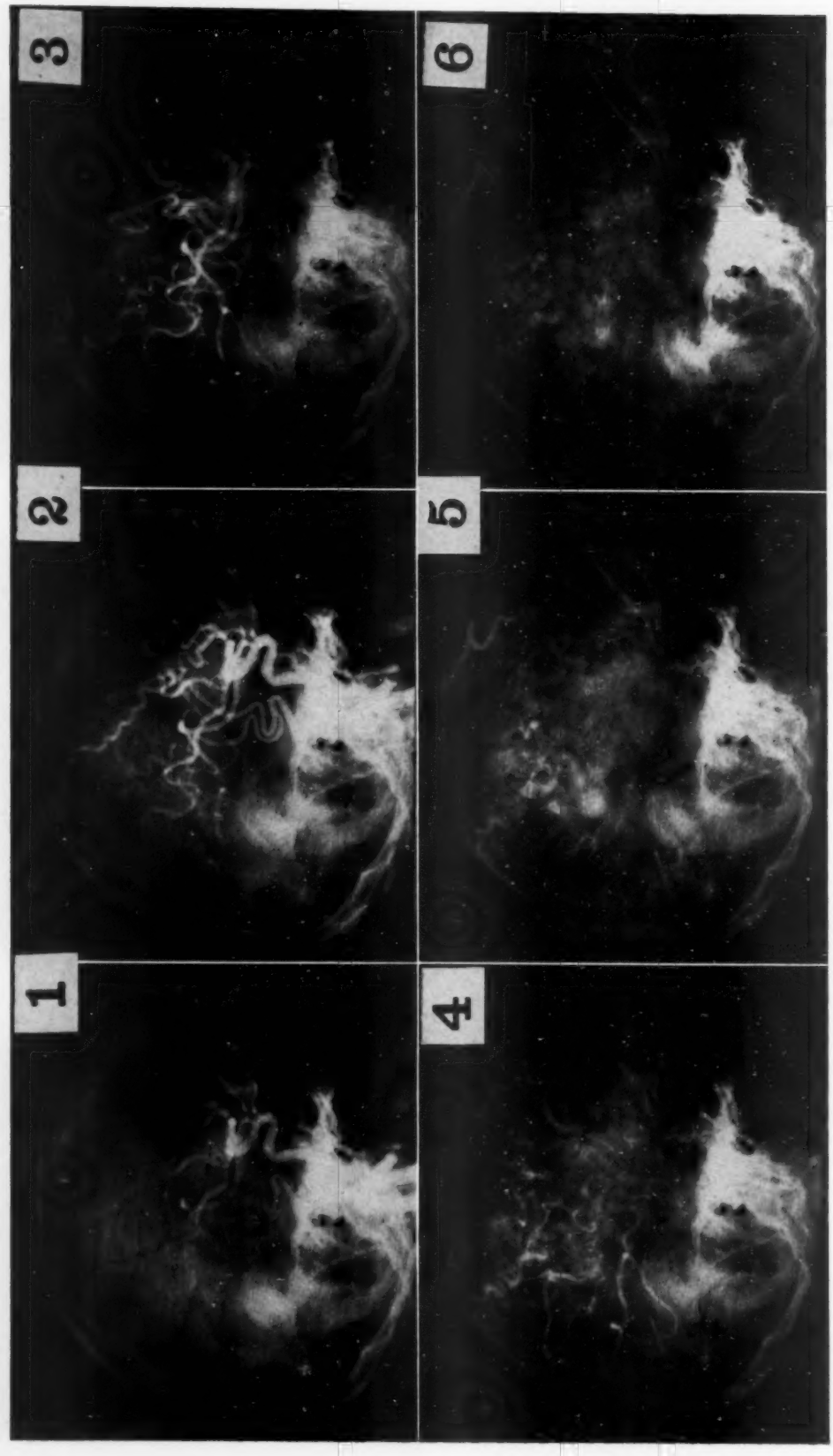

FIG. 5. Complete angiogram in a generalized vascular dystrophy.

varicosities of the brain. The other, in which the blood is flowing definitely more slowly than normal as in certain types of congenital vascular malformations, generalized arteriosclerosis with rigidity of the arteries, tumors or other diseases in which a collateral circulation has been established after a vascular lesion (Fig. 5).

To obtain a complete angiogram when there is slow circulation, the six films are made with standard speed and the usual interval between exposures. The collateral circulation conducts the opaque substance through unusual channels; for instance, when a lesion prevents the sigmoid sinus from accomplishing its function of draining the surface of the brain, the blood will leave through the middle cerebral vein. These considerations made us decide to use six exposures. These six roentgenograms are taken always in the same period of time so that abnormal cases can be compared with the normal. In a normal angiogram the last film will not show any opaque substance remaining in the circulatory system of the brain. However, if the rate of circulation is diminished, the last film will show the presence of opaque substance wherever it may remain.

From the set of six serial roentgenograms we will choose for special study those which depict best the three stages, namely, arteriography, the capillary stage, and the phlebography of the first phase and the second phase. These two phases of phlebography, even though they are included in the venous stage are normally separated chronologically by approximately one-half second. Which of these roentgenograms will be best will depend upon the rate of the circulation. Having in mind the length of time between these principal stages, we can be acquainted with the physiological facts independently of the possible distortion of the roentgenographic anatomy. At the risk of being repetitious, we wish to emphasize that the angiograms furnish, if they are properly taken, not only anatomical or pathological information but also physiological information. This, for example, in cases of concussion of the brain, can be of tremendous importance.

The surgical approach actually adopted is the one that interferes least with the cerebral circulation, and an effort is made to keep the pressure of injection slightly above the systolic pressure of the patient. The most important detail is to know the amount of the opaque substance injected and the length of time employed in injection. The medium should flow freely. The artery injected should not be displaced, clamped, twisted, or temporarily ligated, because these manipulations, if they can be resisted by the patient, have a definite influence on the circulatory process, especially the rate of flow.

It is important to inject both sides of the brain. Very often two completely independent pathological conditions are found, one in each hemisphere. Also, because physiologically an abnormality in the rate of circulation on one side must be accompanied by compensatory, vicarious and physiologically abnormal condition in the other hemisphere.[1] This happens in some cases of thrombosis of the internal carotid artery, in which the obstruction does not interfere with the function of the circle of Willis, consequently with none or few neurological symptoms.

We have observed 2 cases in which the angiograms were normal in timing and normal anatomico-chronologically, but in which the opaque substance was passed from the arterial tree to the capillaries and from them to the inferior sagittal sinus and the great cerebral vein of Galen, and also to the middle cerebral vein. This is abnormal or at least infrequent because the blood customarily goes from the capillaries to the descending and ascending veins first. It is only one and one-half seconds after that stage that the blood reaches the aforementioned sinuses. To make ourselves clear, we should say that even if the whole circulatory sequence were in four and one-half seconds and anatomically there was no evidence of any abnormality, the pathway

of blood was unusual, and that this abnormality may be related to the clinical findings (clinical history and angiogram).

AN AUTOMATIC SERIOGRAPH

The most frequent manner in which serial roentgenograms are obtained in cerebral angiography is the manual shifting of cassettes on conventional roentgen-ray equipment. It is difficult to accomplish this shift under three seconds of time, which imposes a limit on the films available during the period of the passage of the blood through the brain.

One of us (J. M. S-P.) devised a seriograph in which three exposures were available during the period of the passage of the blood through the brain. This device was in the form of a cassette magazine of the appropriate thickness to lie upon the roentgen-ray table and permit roentgenograms with the patient in a comfortable position. In this device it was practicable to place three conventional cassettes but because of their thickness, more than three cassettes appeared impracticable.

In surveying this equipment, it became evident (R. A. C.) that the spring tension device which shifted a new cassette into position with the removal of the exposed one, could also provide the spring tension to maintain proper contact between the films and the intensifying screens within the cassette. This would permit a cassette of one-half the thickness of the conventional one, thereby permitting six cassettes to be placed within the original cassette holder.

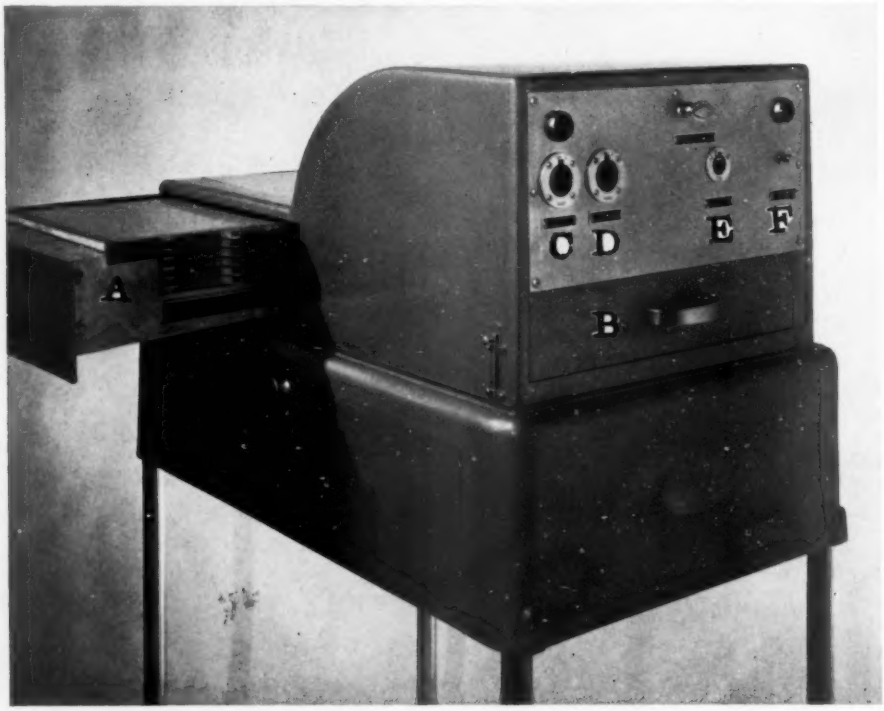

FIG. 6. An automatic seriograph. *A*, loading drawer; *B*, removing drawer; *C*, line switch; *D*, timer switch; *E*, foot switch; *F*, button switch.

Such cassettes were made by V. L. Frickman of the Engineering Department of the University of Southern California, aided by a grant by Peter Lindstrom, M.D.

In making these cassettes it appeared practicable to provide protection of underlying films from secondary radiation by a thin layer of lead inside the back of each cassette rather than by the separate lead

trays which underlay the cassettes in the original device. In practice, this protection proved sufficient. A handle on the cassette facilitating manual removal replaced the handle on the protective tray of the original design.

It was desired to develop from this relatively simple seriograph one fully automatic in operation (Fig. 6), both as to timing of exposures and shifting of cassettes so that the serial exposures would be made at the fixed interval of time most appropriate for cerebral angiography. It was desired also to reduce to the minimum the personnel necessary to conduct the examination. It was desired to place the device in a portable cabinet whereby the examination could be done at any adequate roentgenographic station.

The first requirement was a switch plug installed in the control stand of the roentgen-ray generator to be employed in parallel with its timer.

The seriograph was designed to have the following features:

A two-conductor cable was provided to connect the seriograph electrically through the above-mentioned switch-plug on the control stand of the generator.

A three-conductor cable was provided to connect the seriograph to a source of electric current 110 volts, 60 cycles, and to ground.

An exposure activating device and an automatic cassette-shifting device were provided to operate so that following each roentgen-ray exposure, the cassette was removed and an unexposed one injected into position for the next exposure, the second exposure made and this series continuing until the completion of six exposures. This device provided that the successive exposures should be made at the predetermined fixed interval of time. Two such intervals were chosen, as follows:

Seven-tenths of a second for cerebral angiography and 2.5 seconds for cardiography. The exposure time was to be set at the timer of the control stand of the roentgen-ray generator and was required to be 0.1 second or less.

The cassette shifting device automatically moved the cassettes after exposure from the loading magazine to a rubber-lined drawer from which they were to be later removed for processing.

Devices to control the starting of the seriograph were developed:

a. A foot switch in series with the operative wiring of the seriograph was provided to be operated by the surgeon to permit the starting of the series of exposures. This insured that roentgenograms could not be made until the surgeon was ready. Operating this switch lights a signal indicating to the technician at the seriograph that the surgeon is ready to proceed.

b. A switch button also in series with the operative circuit of the seriograph is employed by the technician stationed there to start the series of exposures.

The device was mounted on a wheeled cabinet to give adequate stability and transportability.

Its height was made adjustable so that it could be adapted to various conventional roentgen-ray tables.

A protective lead layer was included within the cabinet of the seriograph for protection of the technician.

The cassettes were provided with inbuilt lead numbers to designate the chronological order of exposures.

OPERATION OF THE AUTOMATIC SERIOGRAPH

This procedure is divided in two parts, roentgenological and surgical. The number of persons necessary for the roentgenological part can be reduced to two, roentgenologist and technician. The technician's part will be:

To adjust the automatic seriograph to the roentgen-ray table.

To connect the seriograph to the electric current.

To connect the seriograph with the timer of the generator control stand.

To adjust the roentgenographic settings at the control stand so that an exposure time of 0.1 second or less is obtained. Kilovolts and milliamperes as well as focal distance should be decided, having in mind

the 0.1 second exposure time requirement.

The roentgenologist will supervise the positioning of the patient.

Following this, the technician will start the rotating anode after the surgeon requires it and be ready to press the button when given a signal by the surgeon.

The surgical part can be, of course, overemphasized. It seems to us that a quite safe procedure is to have the patient lie on the roentgen-ray table with the head over the seriograph. Under surgical conditions, the neck will be opened about 1 inch above and parallel to the clavicle and the common carotid artery dissected, unless blind puncture is used.

At this time, the surgeon will have the needle in the left hand, the syringe in the right hand and will ask the technician to start the rotating anode. He will then step on the foot switch and start the injection. When the injection is completed, he will indicate with the word "now" that the technician is to push the starting button. The six roentgenograms will then be automatically exposed in four and one-half seconds, the technician will take the cassettes to be developed and the surgeon will keep a piece of gauze in the wound and be ready for the second injection if required for the anteroposterior views.

Local anesthesia will eliminate the necessity of an anesthetist and although an assistant to the surgeon and a nurse are desirable, in extraordinary situations, one of us (J. M. S-P.) did perform a complete angiogram with no other help than that of a roentgen-ray technician.

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Vol. 62, No. 4

NON-PATHOLOGIC VARIATIONS IN RELATIONSHIP OF THE UPPER CERVICAL VERTEBRAE*

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IN frontal roentgenograms of the cervical spine made through the open mouth or using the moving jaw technique as described by Jacobs,[3] the first and second vertebrae are usually well demonstrated. The latter method has been found useful as a routine procedure in examining the cervical spine. In viewing such roentgenograms we have encountered a number of instances in which the first cervical vertebra appeared to be displaced laterally on the second so that the space between the dens and the articular mass of the atlas was much wider on the one side than on the other. Since this finding occurred in individuals who were being examined for non-traumatic as well as traumatic conditions, it was decided to investigate the problem further to determine (1) the frequency of occurrence of such lateral asymmetry in normal persons, (2) the effect of distortion caused by improper positioning of the patient during roentgenography, and (3) the effects of lateral bending and forceful flexion in producing a lateral gliding motion in the facet joints between these two vertebrae.

ANATOMY

There are three diarthrodial joints between the atlas and axis; two are lateral and are formed by the articular processes of the adjacent vertebrae while the third is anterior and is formed by the posterior surface of the anterior arch of the atlas and the anterior surface of the dens. The alignment of these two vertebrae is maintained by anterior and posterior ligaments and also by a strong transverse ligament. This latter structure has been called one of the most important in the body for upon its integrity our lives largely depend. Attached at either end to a tubercle on the inner side of the lateral mass of the atlas, it extends across the ring of the atlas directly behind the dens from which it is separated by a bursa or joint cavity. It serves to keep the dens in close apposition to the anterior arch of the atlas. Further support is lent by two other ligamentous structures, (1) a fasciculus of vertical fibers which extends from the root of the dens upward to the basilar border of the foramen magnum, some of its fibers arising from the transverse ligament, and (2) the atlanto-dental articular capsule, a tough membrane completely surrounding the apposed articular surfaces of the atlas and dens.

According to Morris' Anatomy the chief and characteristic motion between the atlas and axis is rotation with the dens as a pivot. In addition, forward and backward movements and some lateral flexion are permitted. A lateral gliding motion is not described.

LITERATURE

Relatively few observations have been made on the significance of lateral asymmetry of the atlas and axis as seen in frontal roentgenograms. Pancoast *et al.*[4] reproduce the roentgenograms of a cervical spine showing an apparent lateral subluxation of the first on the second cervical vertebra and express the opinion that it represents a variation of the normal. Dankmeijer and Rethmeier[2] report some investigations on the subject. They concluded that lateral mobility of the atlas in relation to the axis was possible and advised caution in the interpretation of an asymmetric position of the dens for the diagnosis of atlas subluxation. This was recognized in part by Coutts[1] who says that the sign of lateral displacement of the atlas (with reference to atlanto-axial dislocations) is subject to

* From the Department of Radiology, University of Wisconsin Medical School and the State of Wisconsin General Hospital. Presented at the Forty-eighth Annual Meeting, American Roentgen Ray Society, Atlantic City, N. J., Sept. 16–19, 1947.

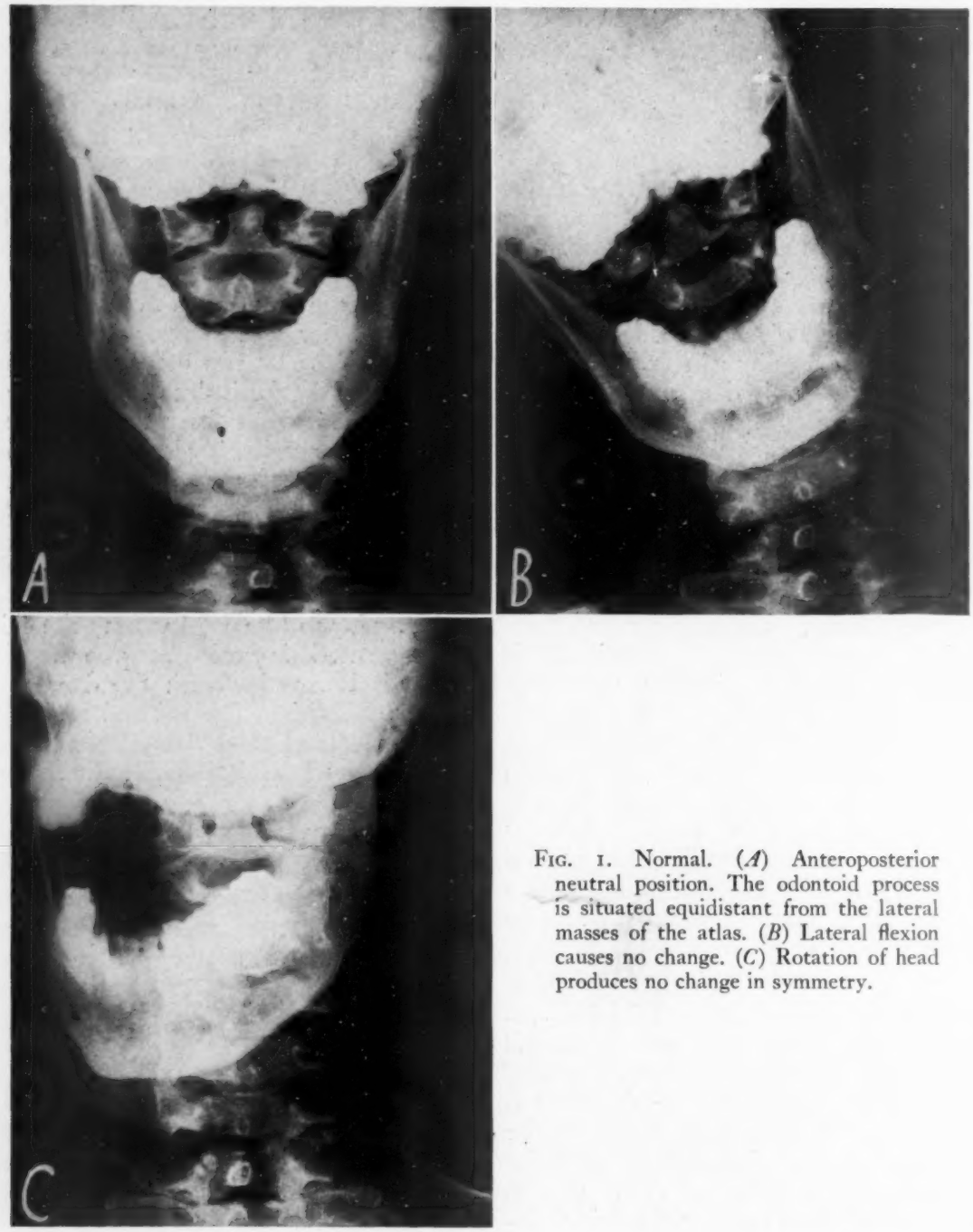

Fig. 1. Normal. (*A*) Anteroposterior neutral position. The odontoid process is situated equidistant from the lateral masses of the atlas. (*B*) Lateral flexion causes no change. (*C*) Rotation of head produces no change in symmetry.

many errors. The first cervical vertebra has a normal lateral mobility on the second as great as that seen in most subluxations. Moreover, whenever rotation is present the second cervical vertebra is foreshortened in the anteroposterior view, giving the appearance of lateral displacement to one or both sides. In order to give significance to this appearance of lateral displacement Coutts believes that the head must be held erect on the spine and both lateral masses must be displaced laterally with respect to the dens. Under these conditions a unilateral displacement represents a pathologic fixa-

tion in a position within the normal range of motion. It might be mentioned in passing that our investigation of normals indicates that even when the head is held in neutral position, no pathologic significance can be attached to lateral movement

absence of a fracture is an increased anterior atlanto-dental interval as seen in the lateral view of the spine. With these observations we are in general agreement.

Others have ascribed considerable diagnostic significance to lateral asymmetry of

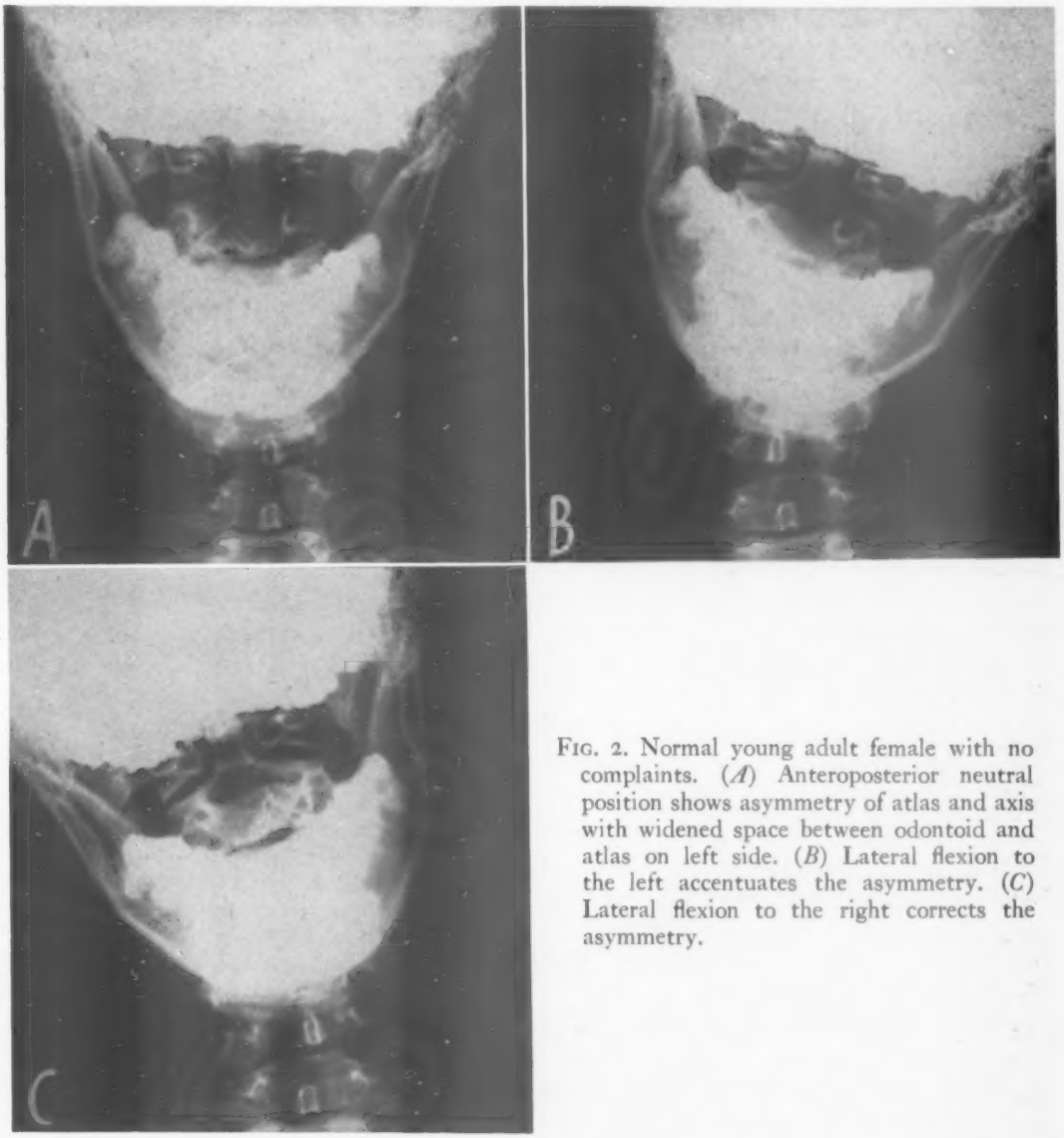

Fig. 2. Normal young adult female with no complaints. (*A*) Anteroposterior neutral position shows asymmetry of atlas and axis with widened space between odontoid and atlas on left side. (*B*) Lateral flexion to the left accentuates the asymmetry. (*C*) Lateral flexion to the right corrects the asymmetry.

of the articular masses on the dens as long as both masses move in the same direction. Coutts also remarks that a bilateral displacement of the atlantal masses in opposite directions indicates a fracture of one of the arches of the atlas and that the only pathognomonic sign of subluxation in the

these two vertebrae as exemplified by Plaut[5] who, in discussing fractures of the atlas, remarks, "In a dislocation of the atlas without fracture the lateral masses would shift for the same distance and in the same direction; the relation of the lateral masses to the odontoid process aids

in determining the nature of the lesion" (whether a dislocation is present with or without fracture of the atlas).

ROENTGEN STUDIES

In anteroposterior roentgenograms made with the techniques mentioned earlier, normally the shadow of the dens is visible lying between the lateral masses of the atlas and equidistant from them. The articulating facet surfaces of the atlas and axis are of symmetrical appearance on the two sides (Fig. 1). In the variation under discussion the atlas appears to be shifted laterally on the axis for a variable distance (Fig. 2). As a result the space between the dens and one articular mass is appreciably wider than on the opposite side and a corresponding lateral shift of the articular masses is evident.

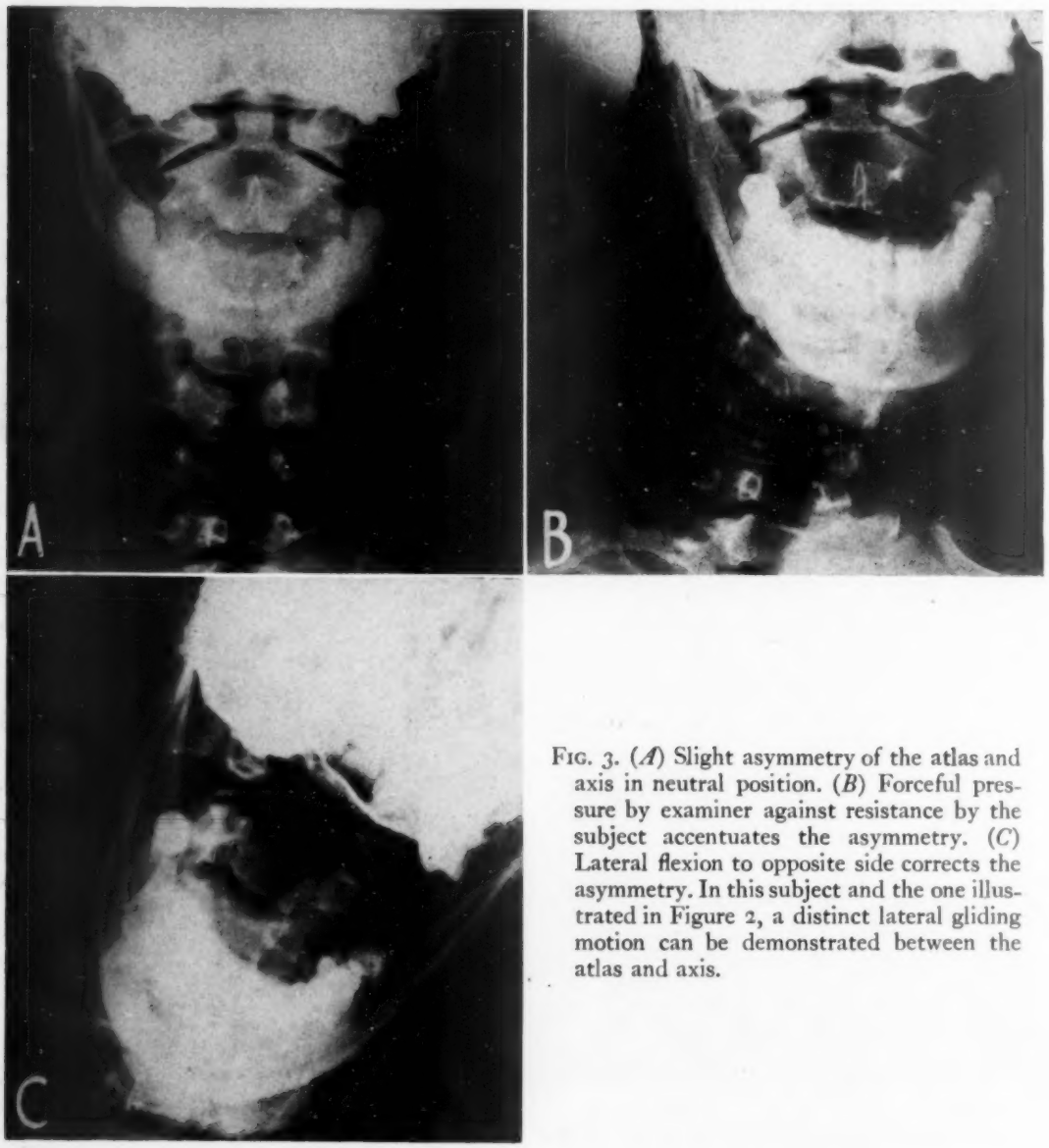

Fig. 3. (*A*) Slight asymmetry of the atlas and axis in neutral position. (*B*) Forceful pressure by examiner against resistance by the subject accentuates the asymmetry. (*C*) Lateral flexion to opposite side corrects the asymmetry. In this subject and the one illustrated in Figure 2, a distinct lateral gliding motion can be demonstrated between the atlas and axis.

In order to determine the frequency of occurrence of this asymmetry a group of 25 apparently normal students was examined. None of these had any present or past

complaints referable to the neck and gave no history of antecedent injury. Anteroposterior and lateral roentgenograms with the head in neutral position were obtained. Sixteen of the 25 were normal. The remaining 9 showed varying degrees of lateral asymmetry.

Next a smaller group of 9 normal individuals, mostly resident physicians and other hospital personnel, was examined. Roentgenograms of these were obtained in five positions: (1) with the head in neutral position, (2) with the head in maximum lateral flexion to the right and then to the left, and (3) with the head upright but with the chin rotated to the left and also to the right. In this group, 3 showed lateral asymmetry with the head in neutral position. This tended to be increased by flexing the head to the side of the shift and to be corrected by flexion to the opposite side (Fig. 2 and 3). Two showed an asymmetry only on maximum lateral flexion to one side or the other. In those roentgenograms made with the cervical spine straight but with the chin rotated to either side, no significant change in relationship of the dens to the lateral masses could be demonstrated. Variations in alignment of the articular facets and in the width of the facet joint spaces was obvious due to the rotatory nature of the motion which is characteristic for these joints.

DISCUSSION

These experiments tend to show that minor degrees of rotation of the head such as might be encountered in practice due to improper positioning of the patient can be disregarded as a cause for lateral asymmetry of these two vertebrae. They also reveal that an appreciable number of normal persons may show such a lateral offset upon routine roentgen examination. Further, they support the conclusion that in some individuals lateral motion of appreciable degree may occur between the atlas and axis. In such a person unilateral muscle spasm might cause a distinct variation in alignment upon roentgen examination. The fact that it is found in neutral position of the head, however, makes it impossible to attach any diagnostic significance to the finding regardless of whether there is a history of injury or not, or whether there is clinical evidence of muscle spasm. As indicated by Coutts, the surest sign of bilateral atlanto-axial subluxation, whether traumatic or spontaneous, in the absence of fracture, is an increased atlanto-dental interval as demonstrated in lateral roentgenograms of the neck.

There are several possible causes of the lateral asymmetry. Variations in shape of the two lateral masses of the atlas are possible. This might explain the apparent difference in alignment of the facet surfaces on the two sides in any one position of the head. Slight tilting of the dens as a congenital variant was seen in one patient by Dankmeijer and Rethmeier. This caused a wider interval between the dens and the articular mass of the atlas on one side than on the other. It seems more likely that in the majority of the cases a slight relaxation or redundancy of the supporting ligamentous structures is present allowing a certain amount of lateral "play" between the vertebrae. This was borne out in studies of several subjects who had shown considerable lateral motion in frontal roentgenograms. Lateral views were obtained with the head in neutral, maximum flexion and maximum extension. In some, but not in all, a definite widening of the space between the dens and the anterior arch of the atlas could be produced.

SUMMARY AND CONCLUSIONS

In anteroposterior roentgenograms of the upper cervical spine an apparent lateral shift of the atlas on the axis is frequently encountered. In a group of twenty-five normal individuals, nine showed some degree of lateral asymmetry between these two vertebrae. Investigation of other normal persons showed that in some a distinct lateral motion of the atlas on the axis could be demonstrated on lateral flexion of the head or by forceful pressure by an examiner

against muscular resistance on the part of the subject.

In the absence of other roentgenographic evidence, no diagnostic significance can be attached to such a finding.

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Vol. 62, No. 4

PULMONARY ADENOMATOSIS WITH A NEW LABORATORY FINDING

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THIS case of pulmonary adenomatosis is reported not only because the disease is rare and it is the first case reported in this area, but because from a search of the literature it is the first case where the clinical diagnosis has been definitely confirmed by a laboratory procedure.

In a review of the literature it is noted that cases have been reported from widely scattered geographical areas. As far as we know, this is the first case that has been reported in Canada.

REPORT OF CASE

A white housewife, aged fifty-four.

Previous Illness. Diphtheria, influenza, appendectomy.

Family History. Mother died of carcinoma. Father died of intestinal obstruction. Six brothers—two killed in war, others alive and well. Three sisters—one alive and well. One died of peritonitis. One died in childbirth.

Personal History. Patient was born in Manitoba. Never lived outside of Canada. Since 1936 she has lived on a dairy farm in the Fraser Valley in British Columbia. At no time has she had any contact with sheep.

Present Illness. Patient had been in good health until five years previously when she began to notice that she was becoming slightly dyspneic on climbing stairs. She paid little attention to this and the dyspnea changed very little until March, 1947, at which time she began to notice that she was tiring more easily and the dyspnea began to increase. However, it was noted that she did her own housework for a family of five and also kept up a vegetable garden for her family. In April, 1947, a roentgenologic survey was being conducted in her area and she attended with the community in general for an roentgen examination. The miniature film revealed roentgen changes and the patient was requested to report to a diagnostic clinic for further study. Figure 1 shows the roentgenogram at that time. All clinical and laboratory findings were within normal limits. Tests made at that time were complete red and white blood counts, tuberculin test was doubtful, coccidioidin was negative, sputum tests for tubercle bacilli and fungus were negative.

By October, 1947, she had developed a cough and slight amount of sputum. Weakness and dyspnea became more marked. Examinations of the chest were all negative. Finally, in January, 1948, she was admitted to hospital with marked increase in her respiratory difficulty, cough, anorexia and beginning loss of weight. At no time did she complain of any pain.

FIG. 1. April, 1947.

Examination. Respiratory movements were accentuated and there were a few scattered moist rales. Examination of the heart was negative. There were no palpable masses and no enlarged glands. The nervous system was within normal limits. Skin was negative. Temperature remained within normal limits. Pulse varied from 80 to 150 per minute and respirations from 20 to 40 per minute. Red blood cells, 5,000,000 per cu. mm.; white blood cells, 12,600 per cu. mm.; differential normal. Hemoglobin

104 per cent. Non-protein nitrogen 41. Roentgen examination of the bone and joint structure was negative. Sputum examination was negative for tubercle bacilli. Roentgenograms of the chest as shown in Figure 2. During the investigations an attempt was made to aspirate one of the larger lesions in the right lung. It was found that despite the extensive pulmonary lesion seen in the roentgenogram, there was no obliteration of the right pleural space. A pneumothorax was inadvertently produced and the procedure was abandoned. Roentgenograms taken after the pneumothorax showed equal collapse of the lung in all planes and no evidence of any pleural adhesions.

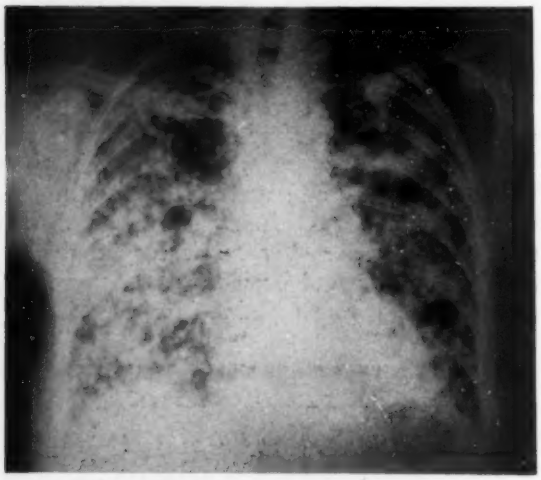


Fig. 2. January, 1948.

Differential Diagnosis. To reach a diagnosis on this case the following conditions were considered:

1. Infections: The case did not appear to fit into either acute or chronic infections. The acute it was felt were readily eliminated and the chronic infections, particularly tuberculosis, were eliminated from the roentgen appearance and the fact that with marked extension of disease the sputum was consistently negative for tubercle bacilli and at no time was there a fever.

2. Inhalation and Aspiration Lesions: These were eliminated by history.

3. Carcinoma: This did not have the appearance of a primary carcinoma of the lung and no primary lesions could be found elsewhere. Also, the patient continued to be well nourished until nearly the end of her illness and it was felt that carciuoma could be eliminated.

4. Sarcoid: This did not have the general appearance of sarcoid. The lesion tended to be progressively worse and at no time showed any clearing and did not appear to be typical in any way of sarcoidosis.

5. In general, lesions relative to the vascular system, the bronchi, and allergic phenomena and those related to the hemopoietic and metabolic functions could be ruled out.

6. Pulmonary Adenomatosis: By a process of exclusion it was felt that the most likely diagnosis in this patient was pulmonary adenomatosis so that a definite clinical diagnosis was made and the laboratory asked to search the sputum to see if anything could be found.

Considering the general pathological picture of pulmonary adenomatosis it would appear that with the extensive lesions which this patient had, some of the cells that grew out in the alveolar structures would break off and would be found in the sputum. The laboratory consistently found groups of cells in the sputum that were unusual. These are reproduced in Figure 3 in both high and low power. From the consistent findings of these groups of cells our pathologist made a specific diagnosis of pulmonary adenomatosis.

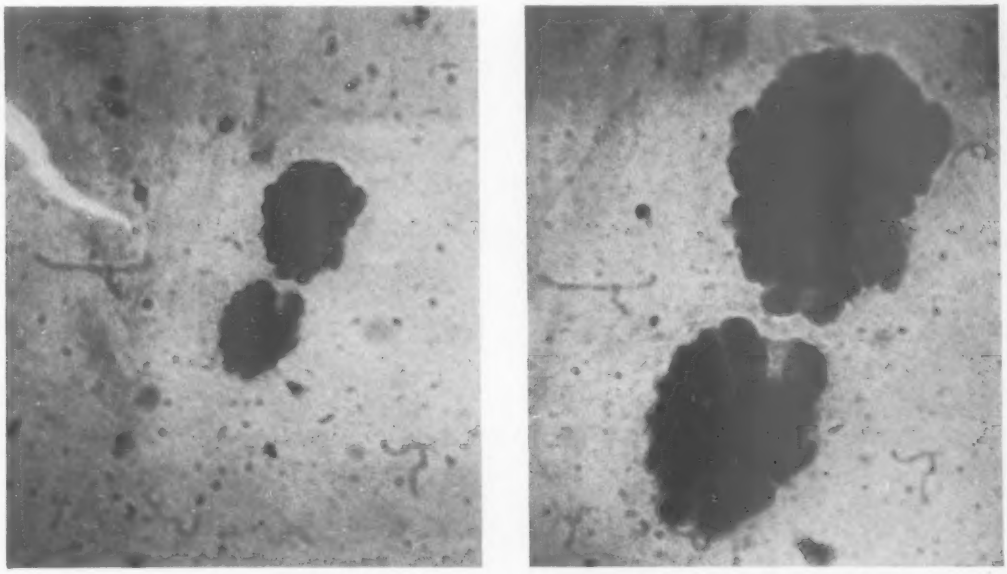
Progress of Case. This patient's lesion steadily progressed and her condition become steadily worse, no form of therapy being of any benefit. She eventually died on February 27, 1948.

Pathological Report. Repeated examinations of sputa (Jan. 28, 30, 31, Feb. 3) revealed consistently regular findings. Smears from these specimens of sputum showed a number of small circumscribed round or oval masses of epithelial cells. The striking feature of these masses of cells was their very regular ovoid outline and the similarity in size and shape of such masses in the various specimens of sputum. The cells were fairly regular in size and shape; mitotic figures were not seen and the process appeared to be benign. With the finding of these polypoid epithelial masses in several specimens of sputum, it was concluded that the clinical diagnosis of pulmonary adenomatosis had been corroborated.

Autopsy Report (Four and a half hours after death). On opening the thoracic cage the sternum was removed with ease. The right pleural cavity contained a very small quantity of serous fluid and there were no adhesions between the parietal and visceral pleura. In the left

pleural cavity there were a number of fine, very easily separated adhesions between the parietal and visceral pleura. This pleural cavity contained only a small, normal quantity of pleural fluid.

Both lungs were in an expanded state and filled both pleural cavities. The lungs had a nodular feeling and could be compressed. The tracheobronchial tree was inspected and there were found a number of hard, shot-like, somewhat enlarged lymph nodes at the bifurcation of the trachea. The nodes were not definitely matted together and could be separated singly without undue trouble. The cut surfaces of these nodes presented a whitish, firm peripheral portion, and an anthrocotic center. About the hilum of both lungs similar enlarged, firm, shot-like nodes were found. The tracheobronchial tree was opened from behind and contained a quantity of moderately thick mucinous, bubbly sputum. This was not purulent, but appeared of a more glairy nature. The actual mucosa presented some injection but this was not a marked feature. Upon removal, the right lung remained in an expanded state and on its external surface it presented innumerable numbers of somewhat umbilicated nodules, of whitish color. These nodules were firm and between them was normal appearing pulmonary tissue (Fig. 4). The interlobar planes were clearly demarcated and there were no adhesions between the upper, middle and lower lobes. On sectioning the right lung, the cut surface presented a large number of whitish tumor masses varying from 2 mm. in diameter to more coalescent groups, the largest being approximately 4 cm. in diameter (Fig. 5). Between these white tumor masses could be seen reddish-brown, normal appearing pulmonary parenchyma. The replacement of pulmonary tissue by tumor had been so extreme that the brownish parenchyma appeared as threads between the masses. The masses were of a firm, rubbery consistency and did not retract below the cut surface. On pressure, a certain amount of milky exudate could be expressed from the nodules. On tracing the bronchi, the main stem and secondary bronchi were not remarkable. The tertiary bronchi could be traced and under the mucosa, bulging slightly into the lumina, could be seen a number of whitish raised areas. The left lung showed on its pleural surface a number of the thin strands of the previously mentioned fine pleural adhesions. The interlobar fissure was obliterated by adhesions. On sectioning the lung the cut surface presented an appearance exactly the same as that seen in the right lung. The bronchi were similar to that described on the right side. Each lung weighed 1,500 grams.



A B

Fig. 3. (*A*) 400×; (*B*) 900×.

Microscopical Examination. Lungs: Smears

taken of the mucus found in the tracheobronchial tree showed numerous oval, circular cellular formations similar to those described as being found antemortem in the sputum. Sections taken through the bronchi and trachea showed no definite abnormality. The lining was of a tall columnar type of epithelium. Sections of the pulmonary parenchyma (Fig. 6) demonstrated the general architecture to be maintained. The stroma was not altered. Between the tumor masses noted in the gross description were lines of normal appearing pul-

Fig. 4.

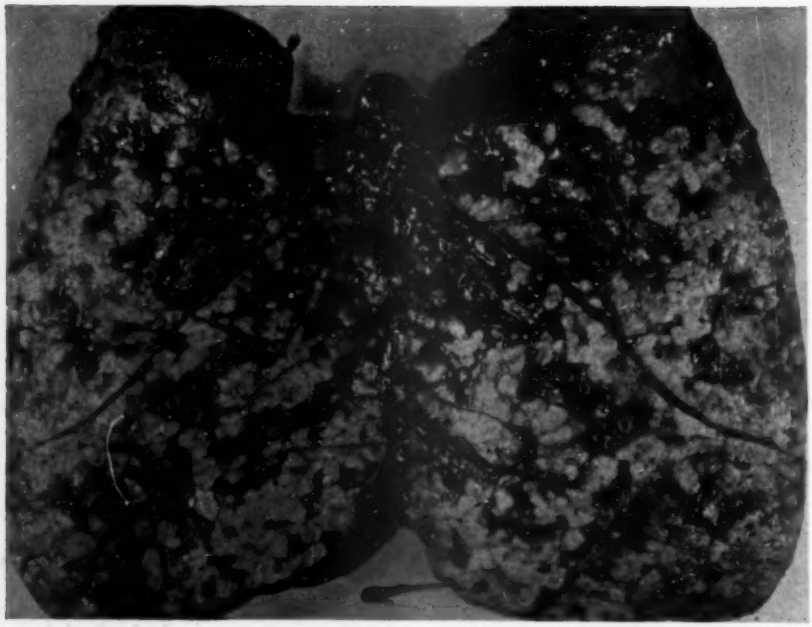


Fig. 5.

monary parenchyma. In the tumor structures (Fig. 7) the alveolar elements were made up of lines of cubocolumnar cells which were generally arranged in a single layer along the alveolar walls. These cells showed a pale translucent cytoplasm and regular vesicular nuclei placed in the basal section of the cells. There were no mitotic figures seen and the striking feature was the regularity of the cells. In many areas, the lining wall of the alveoli showed innumerable papillary infoldings. The microscopic picture of the affected alveoli was somewhat similar to that seen in the non-expanded fetal lung. In general, the affected alveoli tended to be grouped together, but scattered throughout the whole parenchyma were isolated alveoli which showed this same unusual cellular lining, while the surrounding alveoli presented an essentially normal appearance, other than for their lumina being filled with amorphous, pale staining coagulum. The terminal bronchioles could be recognized in the sections, and they showed a completely normal histological appearance. The whole picture appeared to be one of reversion to an early fetal type of alveolar epithelial, accompanied by polypoid proliferation. The histopathological picture was not one of malignant tumor.

Lymph Nodes: Sections taken through the hilar lymph notes and those at the bifurcation of the trachea showed the normal lymphadenoid tissue to be in many instances nearly completely replaced by cellular elements arranged in alveolar forms, similar to those described in the lung. Sections taken through the lymph nodes in other areas than these showed an essentially normal histological picture.

The remainder of the postmortem revealed no evidence of any other metastatic lesions and no possible source of a primary carcinoma.

Conclusions. This case shows clinically a progressive replacement of pulmonary tissue with resultant death by asphyxia. Whether this replacement is of an inflammatory nature or a neoplastic nature or halfway between the two is almost impossible to say. Certainly the microscopic picture is not that of a malignant tumor, but the presence of deposits in the hilar lymph nodes is a strong point for malignancy. For lack of a better term, this might be called metastasizing pulmonary adenomatosis.

DISCUSSION

This disease has a pathological picture

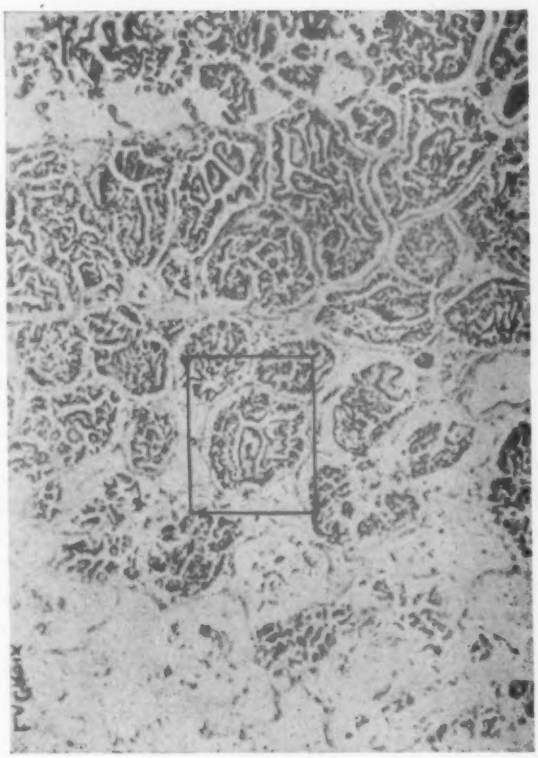


Fig. 6. 80×.

Fig. 7. 400×.

closely resembling a pulmonary lesion appearing in sheep which has received various names such as jaagsiekte, pulmonary adenomatosis, epizootic adenomatosis and infectious adenomatosis. A great deal has appeared in the veterinary literature and it has been presumed that the disease as it appears in sheep is of an infectious nature. Loehlein in 1903 found a picture resembling this condition in a sixty-nine year old woman. Similar cases have more recently been reported by Sims, Taft and Nickerson, Paul and Ritchie, and others.

Alveolar cell carcinoma of the lung usually presents some recognizable degree of malignant activity such as stromal invasion, mitotic figures, giant cell formation and more anaplasia than is seen in this case. If this is a case of alveolar cell carcinoma then it presents a microscopic picture that would be extremely difficult to diagnose as malignant except for the lymphatic metastases. Perhaps this condition is similar to those benign appearing adenomata of the thyroid gland which occasionally give rise to solitary metastases.

The disease as it appears in humans, however, is such that to date no satisfactory etiological basis has been determined. It is a hyperplasia of the pulmonary alveolar epithelium without the usual microscopic evidences of malignancy such as an invasion of the alveolar walls or mitotic figures, but which can metastasize.

The microscopic pictures of the pathological process in the lung of this patient clearly show the extensive papillary development within the alveoli, the intactness of the interalveolar structures and the lack of mitotic figures. It is apparent in examining these slides that there would logically be some breaking off of these cells to be extruded into the bronchi and brought up into the sputum. Consequently, one would expect that when the disease is present, particularly if it is fairly well advanced, the sputum examination should be confirmatory of the diagnosis, such as has been shown in this case.

This case is of further interest in that this patient had an extensive pulmonary lesion and was carrying on a normal life and the lesion was only found in its relatively early stage in a mass community roentgenologic survey.

The course of the disease also demonstrates to what extent the pulmonary alveoli can be altered before clinical symptoms appear.

SUMMARY

1. A case of pulmonary adenomatosis is presented complete with clinical findings, course and postmortem report.

2. The pathology of the disease is discussed.

3. A method of recognizing the condition by the examination of the sputum is given.

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Vol. 62, No. 4

MULTIPLE CHARCOT JOINTS*

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SINCE Jean Martin Charcot[1] described the neuropathic joint of tabes in 1868, there have been numerous case reports, theoretical discussions and critical analyses on all phases of this subject. The purpose of this paper is to present a most unusual case of multiple Charcot joints occurring in a male patient afflicted with tabetic neurosyphilis.

CASE REPORT

The patient, a white male, aged sixty-four was first admitted to the Los Angeles County Hospital in May, 1931. He was complaining of severe shooting pains in his lower extremities. He stated he had a penile lesion in 1913. In 1926 a private physician told him he had a positive blood test for syphilis and gave him three courses of hip and arm injections. Just prior to this hospital entry another private physician had given him one course of hip and arm injections and one course of malaria fever therapy. The pertinent findings on physical examination revealed a positive Romberg test, Argyll-Robertson pupils and absent knee and ankle jerks. The blood and spinal fluid Wassermann tests were positive. No joint deformities were noted.

The patient was readmitted to the hospital in December, 1937, because of swelling in his right elbow not related to trauma. Examination revealed the same neurological findings as noted before. The blood and spinal fluid Wassermann reactions were positive and there was a mid-zone colloidal gold curve in the spinal fluid. The

FIG. 1. Left elbow. Gross deformity consisting of severe hypertrophic bone changes with fragmentation, eburnation and dislocation.

FIG. 2. Right elbow. Same as Figure 1.

[1] Charcot, J. M. Leçon sur les maladies nerveux. Fourth Lesson. New Sydenham Series, 1868.

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Fig. 3. Left knee. Hypertrophic arthritis with fragmentation. (Findings in right knee are similar and the roentgenogram is therefore not included.)

Fig. 4. Lumbar spine. Severe hypertrophic changes in all the lumbar vertebrae.

patient was referred to the Social Hygiene Clinic where he was started on intensive antiluetic treatment. He was given a series of alternating courses of bismuth and mapharsen until 1942 at which time the blood Wassermann reaction was reported as negative.

In August, 1938, he complained of swelling in his left knee and on examination he was found to have an unstable knee with hyperextensibility. Roentgen examination revealed fragmentation at the anterior and medial distal articular margins with considerable eburnation of the adjacent bone. Marginal osteophytes at the patellar articular margins were also noted.

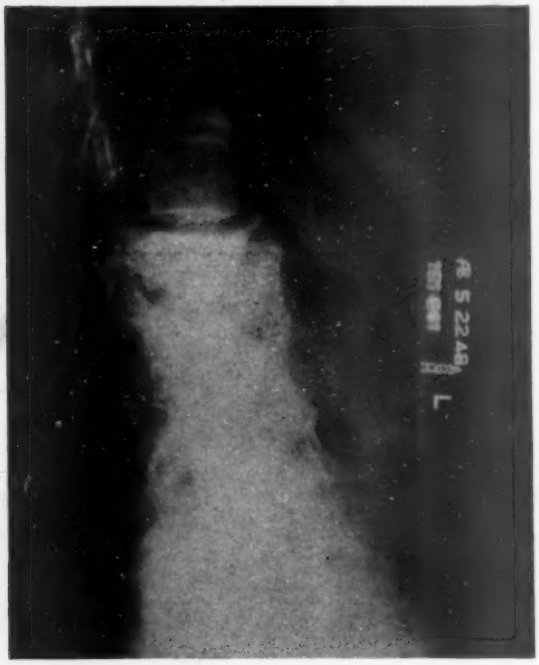

Fig. 5. Lumbar spine, lateral view.

In April, 1940, he complained of weakness in his right knee and by July, 1940, he noted some swelling of that knee. In August, 1940, he was advised to wear a long leg appliance because both knees were unstable at that time.

In January, 1942, he was admitted to the urological service because of symptoms referable to a cord bladder. During a routine roentgen examination the third, fourth, and fifth lumbar vertebrae showed considerable sclerosis, deformity and osteophyte formation consistent with the diagnosis of a Charcot spine. The second lumbar vertebra appeared only slightly involved. The patient had no complaints referable to his back at that time.

FIG. 6. Both hands. Left hand shows prominent bony hypertrophy of the distal portion of the metacarpals.

This patient was last seen on the medical service in February, 1948. He entered because of mild pains radiating up and down his arms and legs. Physical examination revealed the characteristic neurological findings of tabes dorsalis. A complete sensory examination excluded syringomyelia as a diagnostic probability. Both elbows and both knees revealed marked instability and hypermobility.

The important roentgen findings are shown in Figures 1, 2, 3, 4, 5 and 6. Roentgen findings in the pelvis, hips, shoulders, ankles and skull were not remarkable. A roentgenogram of the right foot showed an unusually abundant callus about an old fracture of the shaft of the fourth metatarsal.

Comment. At the present time the patient is able to use a wheel chair and to some extent can walk on crutches. He is without pain. There is no evidence of trauma associated with these joint changes. The joint deformities have been progressive in spite of late antiluetic treatment.

SUMMARY

An unusual clinical picture of multiple neuropathic joints in a patient with tabetic neurosyphilis has been presented.

The assistance of Dr. R. A. Carter of the Department of Roentgenology is greatly appreciated.

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ROENTGENOLOGIC FINDINGS IN OSTEOMYELITIS FOLLOWING BONE MARROW INFUSIONS IN INFANTS

REVIEW OF LITERATURE AND REPORT OF TWO CASES

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THE bone marrow has been of interest to investigators and hematologists for some years and recently the marrow space has assumed importance as a route for parenteral therapy. The value of intraosseous infusion in pediatrics has been noted;[1,6] however, despite enthusiastic reports this route of medication has not received general acceptance.

Several reasons may account for this. In some instances, proficiency in the use of intravenous therapy may nullify the need for an alternate route. When intraosseous infusion is attempted by inexperienced personnel, a high incidence of failures and complications is likely to follow.

Of the possible complications there are two of serious nature. The first, mediastinitis, is fortunately rare, but it should be nonexistent.[8,12] The cases which have occurred in infants or children have been due to the use of the sternum as a transfusion route in spite of the repeated admonition that the sternum should not be used below the age of three.

The second major complication is osteomyelitis. In our series of 383 intraosseus infusions we have had 2 cases of osteomyelitis, the reports of which follow:

Case 1. This female infant, aged nineteen days, was admitted to the Pediatric Service on September 15, 1946, with a diagnosis of pyloric stenosis. During her period since birth she had only gained back to her birth weight of 6 lb. 2 oz. In addition to antispasmodics and appropriate feeding routines, 3,580 cc. of various solutions were given by intraosseous infusion. These solutions included 5 per cent dextrose in distilled water or in normal saline, whole blood, plasma and 5 per cent amigen. On two occasions these fluids were given as continuous infusions, once for twenty-four hours and once extending over a period of four days. At the end of the last continuous infusion, which did not run well, it was noted that the needle adaptor was cloudy. The needle was removed and approximately 20 cc. of purulent material was expressed from the soft tissues around the needle site. Penicillin (25,000 units) was injected locally, and parenteral penicillin was given at the rate of 50,000 units every two hours. A roentgenogram of the left tibia showed an osteitis involving the upper part of the

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Fig. 1. Case 1. *A*, the roentgen study of October 8, 1946, demonstrates a defect in the lower part of the diaphysis of the left femur, indicative of a recent intraosseous blood transfusion. A similar defect with surrounding osteitis and periostitis is demonstrated in the upper end of the diaphysis of the left tibia, also indicating evidence of a recent intraosseous blood transfusion, and at this time suggesting evidence of early infection at the site of injection.

B, the studies of October 15, 1946, again demonstrate the defects in the upper end of the diaphysis of the left femur, which are slightly more prominent and typical of the usual findings following an intraosseous blood transfusion. The findings in the upper end of the left tibia show definite bone destruction at this time, indicating a rather well developed osteomyelitis.

C, the studies of October 29, 1946, show evidence of a healing osteomyelitis involving the upper part of the diaphysis of the left tibia, with good bone regeneration being well demonstrated at this time.

D, final studies of January 20, 1947, demonstrate the osteomyelitis involving the upper end of the diaphysis of the left tibia to be completely healed.

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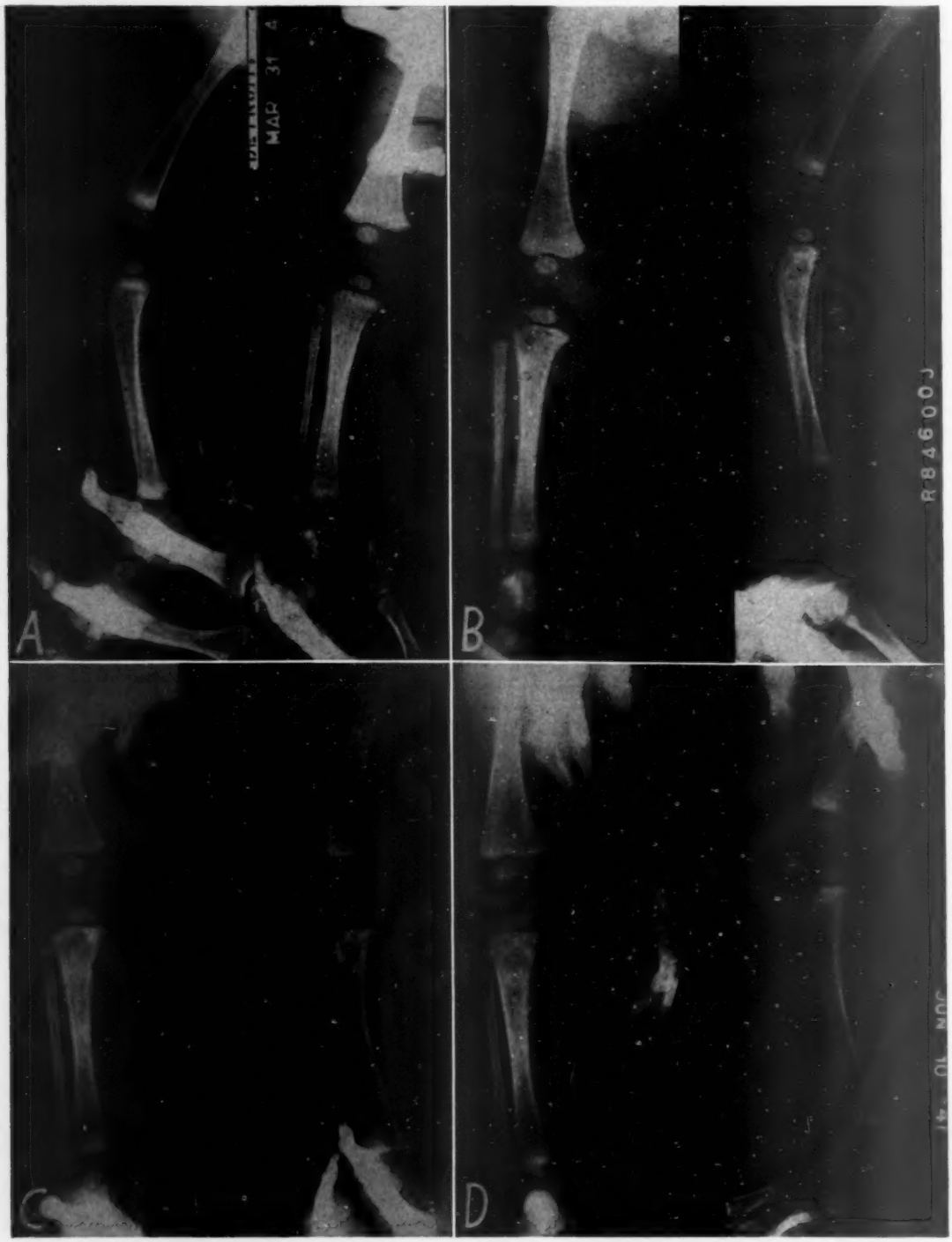

FIG. 2. Case II. *A*, the roentgen studies of March 31, 1947, demonstrate a small defect in the upper end of the right tibia indicative of a recent intraosseous blood transfusion. The bony structures are otherwise negative.

B, the studies of April 11, 1947, demonstrate evidence of a well developed osteomyelitis involving the upper end of the diaphysis of the right tibia, about the site of the previously described intraosseous blood transfusion.

C, the studies of May 2, 1947, demonstrate the osteomyelitis involving the upper end of the diaphysis

diaphysis of the left tibia, with a small sequestrum in this region (Fig. 1).

By October 14, 1946, it was decided that medical treatment would not control the pyloric stenosis and after giving 75 cc. of whole blood and 130 cc. of plasma into the right femur a Rammstedt pyloroplasty was done. Postoperatively 500 cc. of 5 per cent dextrose in distilled water was given through the needle in the right femur and penicillin was continued 50,000 units every two hours.

Roentgenograms at weekly intervals showed an osteomyelitis involving the upper 1.5 cm. of the diaphysis of the left tibia. Roentgenograms on October 29, 1946, showed a definite evidence of healing and by November 12 there was no evidence of activity. On November 15, 1946, the infant was discharged weighing 7 lb. 6 oz. Final roentgenographic studies on January 20, 1947, indicated complete healing of the osteomyelitis.

Case II. This female infant, aged two months, was admitted to the Pediatric Service on March 24, 1947, with a history of diarrhea for three weeks. At the onset of the diarrhea, the weight was 9 pounds. She was given into the right tibia, by continuous drip, 500 cc. of glucose in saline, 500 cc. of 10 per cent glucose in distilled water, 100 cc. of parenamine and 100,000 units of penicillin. In the next five days the diarrhea rapidly subsided but at the end of this time there was generalized edema of the lower half of the body and depression of the fontanelles.

On her seventh hospital day a routine roentgenogram of the right upper tibia was taken (Fig. 2*A*). There was a defect in the upper part of the diaphysis indicating evidence of an intraosseous blood transfusion. No evidence of osteitis or periostitis was noted.

On the eleventh day she began to run a febrile course, and on the seventeenth day was very irritable. A raised, red, indurated area was noted on the right tibia at the site of the previous infusion. At this time a roentgenogram showed an osteomyelitis involving the upper half inch of the diaphysis of the right tibia, with marked evidence of bone destruction (Fig. 2*B*). Grossly the upper third of the right leg had evidence of an acute infection and *E. coli* was obtained by culture. Penicillin (100,000 units) was given intramuscularly every two hours.

By the twentieth day her temperature was normal and the involved area was much improved. A roentgenogram on her twenty-fifth hospital day showed further bone destruction with increased periosteal reaction. On her thirtieth day 70 cc. of blood was given into the left tibia because of a moderate anemia. Subsequent roentgenographic studies showed no further evidence of bone destruction and on the thirty-ninth day there was evidence of a healing osteomyelitis. (Fig. 2*C*). She was discharged on May 7, 1947, in good health weighing 9 lb. 11 oz.

A follow-up roentgenogram on June 10, 1947, indicated complete healing of the previously described osteomyelitis involving the upper end of the diaphysis of the right tibia (Fig. 2*D*).

In our review of the literature we have been able to find only 19 cases of osteomyelitis secondary to intraosseous infusion in infants. To these we add our 2 cases (Table 1).

It is probable that 2 of these cases should not have had infusions by this route. Case 7 was transfused through severely burned skin, and Case 8 had septicemia with multiple abscesses at the time of infusion. Ten of the 16 cases where data were complete were associated with the use of continuous infusions. In 4 instances, the infection developed following the use of hypertonic solutions (Cases 16–19), and both of our cases followed the use of protein hydrolysates.

Heinild *et al.*[5] believed that both the use of hypertonic solutions and continuous infusion played a major role in the patho-

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of the right tibia which is healing well, and excellent bone regeneration is demonstrated, along with some new periosteal bone formation. No evidence of any spread of the process since the earlier studies can be noted.

D, a final examination on June 10, 1947, demonstrates a complete healing of the osteomyelitis involving the upper part of the diaphysis of the right tibia. The site of the osteomyelitis is now indicated only by a slight sclerosis of the bone in that region.

TABLE I

SUMMARY OF REPORTED CASES

Case No.	Author	No. of Infusions Reported	Diagnosis	Sex	Age	Location of Osteomyelitic Organisms	Method of Infusion	Solutions Used	Roentgen Findings	Treatment	Results Sequelae
1	Behr	60+	—	—	—	Tibia	Cont. ?	—	—	Surgical	Complete healing
2	Rooney	250	Diarrhea	—	1 mo.	Femur, lt. hemolytic streptococcus and *Staph. aureus*	Cont. 3 hours	Blood—50 cc. Saline—75 cc.	Extensive destruction of distal third of diaphysis, periosteal proliferation	Surgical incision local and oral sulfathiazole	Complete healing in 7 weeks, no residual
3	Rooney	250	Diarrhea	—	3 mo.	Tibia, lt.	Cont. ? hours	Blood—80 cc. Saline—250 cc.	No evidence of bone destruction	Surgical incision local and oral sulfathiazole	Complete healing in 7 weeks, no residual
4	Reisman and Tainsky	?	Erythroblastosis fetalis premature	—	Newborn	Femur, lt.	Direct	Blood—60 cc.	Periosteal thickening, distal fourth of femoral diaphysis	Surgical incision, local use of 5% Na sulfathiaozle and 1:10,000 zephiran Cl.	Complete healing, no residual
5	Tocantins, Price and O'Neill	79	—	—	—	—	—	—	—	—	—
6	Tocantins, Price and O'Neill	79	—	—	—	—	—	—	—	—	—
7	Levy	?	Severe burn	—	—	Tibia	—	—	—	—	—
8	Stokes	?	Septicemia, multiple abscesses, anemia	—	2 mo.	Tibia, rt.	—	Blood	—	—	—
9	Gunz and Dean	35	—	—	—	—	Direct	Saline	—	—	Complete healing ?
10	Gunz and Dean	35	Empyema	—	18 mo.	Tibia?	Cont. 12 hours	Blood	—	Surgery	Complete healing ?
11	Gunz and Dean	35	Erythroblastosis fetalis	—	11 mo.	Tibia ?	Cont.	Blood	—	Surgery	Complete healing ?
12	Quilligan and Turkel	45	Congenital duodenal obstruction	—	Newborn	Tibia, 45	Cont. 4 days	—	—	None	Died with duodenal obstruction, generalized peritonitis, osteomyelitis of entire rt. hip.

13	Quilligan and Turkel	—	—	—	—	—	—	—	—	—	—
14	Walsh and Zadek	—	Acute appendicitis with diffuse peritonitis	F	3 yr.	Tibia, lt.	Cont. ?	Glucose in saline, plasma, blood, penicillin	Osteomyelitis with rarefaction within ½ inch of upper epiphyseal plate	Incision, later saucerization, penicillin	Complete healing, no residual
15	Heinild *et al.*	982	Diarrhea	—	2 wk.	Tibia, lt.	Cont. 32 hours	Serum—220 cc. Saline—50 cc.	Rarefaction in proximal metaphysis	Saucerization	Complete healing 2 mo. At 14 mo. 1 cm. shortening of left leg
16	Heinild *et al.*	982	Premature infant with edema	—	Premature	Tibia, rt.	Direct	Concentrated serum—20 cc.	Extensive osteomyelitis with large osseous abscess in metaphysis, total necrosis of entire diaphysis, enveloped by vigorous sequestral capsule	Surgical	Complete healing 1 mo. Died in 5 mo. of intercurrent infection
17	Heinild *et al.*	982	Diarrhea	—	10 wk.	Tibia, lt.	Direct	50% glucose in saline—10 cc.	Progressive osteomyelitis, extensive destruction proximal metaphysis, vigorous periosteal formation around diaphysis	Penicillin	Healing with 1 cm. shortening at 6 mo. X-ray epiphyseal line almost effaced, zone of ossification irregular, metaphysis broadened
18	Heinild *et al.*	982	Diarrhea	M	6 wk.	Tibia, lt.	Direct	50% glucose—20 cc.	Typical osteomyelitis, extensive destruction of proximal metaphysis, periosteal reaction of entire metaphysis	Penicillin	Complete healing at 8 mo. X-ray slightly irregular epiphyseal line
19	Heinild *et al.*	982	Diarrhea	F	1 wk.	Tibia, lt.	Direct	50% glucose—10 cc.	Extensive osteomyelitis, focal destruction of proximal metaphysis, area of rarefaction in distal metaphysis, total necrosis of entire diaphysis with vigorous sequestrum	Sulfathiazole	Complete healing. Died intercurrent infection 1 mo. later

genesis of osteomyelitis following intraosseous infusion, for in their series all 5 cases of osteomyelitis were associated with the use of continuous infusion or hypertonic solutions. They found the risk of osteomyelitis following the use of continuous infusion or hypertonic solutions to be 13 per cent. However, in our series[11] only 2 of 33 infants who received continuous infusion developed osteomyelitis, an incidence of 6 per cent.

The over-all risk of osteomyelitis is difficult to ascertain. However, if the three largest series of infusions reported are totaled, some idea of its calculated risk can be obtained.

Table II

Author	No. of Infusions	Cases of Osteomyelitis
Meola[6]	326	0
Texter and Kaump[11]	383	2
Heinild *et al.*[5]	982	5
	1691	7

Percentage of osteomyelitis—0.41 per cent

SUMMARY

We have presented the clinical and roentgenologic findings in two cases of osteomyelitis secondary to intraosseous infusion and in addition have summarized the other nineteen cases reported to date.

The over-all risk of osteomyelitis in this procedure is low (0.41 per cent) unless hypertonic solutions or continuous infusion is used when the risk becomes much greater (6–13 per cent).

Intraosseous infusions are further contraindicated in the presence of severe skin or generalized blood stream infections.

In none of these cases reported did the infection prove fatal, and in all cases complete healing occurred without residual change.

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CHANGES IN THE COAGULABILITY OF THE BLOOD AFTER RADIATION THERAPY

THE RESULTS OF STUDIES USING THE MODIFIED WAUGH-RUDDICK TEST FOR INCREASED COAGULABILITY*

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THE need for a test to detect finer changes in the clotting process, especially when an increased coagulability is present, was met by Waugh and Ruddick,[37] who put the clotting mechanism into "slow motion" through the use of heparin. By this means, any change in the clotting time is magnified and easily measured. A modification of the original test has recently been described,[34] which further increases the ease and accuracy with which blood coagulation studies can be made.

Having previously studied the effect of operation on the coagulability of the blood,[34] it was decided to apply the modified test to an investigation into the effect of irradiation on the coagulation process.

REVIEW OF THE LITERATURE

There is no agreement among workers in this field as to the effects of irradiation on blood coagulation. This is due to numerous factors, including the use of different coagulation tests, differences in the amount and intensity of radiation employed, as well as different time-intervals between the application of radiant energy and the performance of the coagulation test. Some of these causes of disagreement will be discussed below.

Following exposure of the spleen to irradiation, a decreased coagulation time was reported by Stephan,[35] Jurasz,[14] Osgood,[19] and most recently by Ostro and Macht.[20] This was variously attributed to an increased funtion of the splenic pulp,[35] and a disintegration of lymphocytes in the splenic follicles with liberation of thromboplastic substances.[36] Other workers report similar results following irradiation of areas other than the spleen,[3,5,11,21–25,31,40] and explain the change as being due to the liberation of a "blood coagulation accelerating" cytozyme from disintegrated leukocytes and platelets;[11] to an increase in platelets, prothrombin and fibrinogen;[31] to an undetermined direct action on the blood itself;[21–24] and to an acceleration of the transformation of prothrombin to thrombin.[40]

On the other hand, a decreased coagulability of the blood following irradiation has been reported by Lacassagne *et al.*,[17] Fabricius-Möller,[9] Bernhard,[3] Pfahler,[26] Zunz and La Barre,[40] Reding,[29] Kaufmann,[15] Allen and co-workers,[1,2] and Rekers and Field.[30] Among the factors said to be involved here are a decrease in blood platelets,[9,17] a prothrombin deficiency,[15] and the production of an anticoagulant substance resembling heparin.[1,2] Reding,[29] studying the coagulation time of recalcified plasma following irradiation, found a decreased coagulability in 80 per cent of 15 cancerous patients irradiated for the first time. Four patients who had received four to six series of radiation treatments all showed a decreased coagulability of the blood.

Of the various factors involved in the clotting process, the platelets (i.e. thromboplastin) and fibrinogen have received the most study as regards the effect of irradiation. Portis[27] found the platelets unchanged in a series of roentgen-ray workers. A large dose of radiation is said to cause a

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fall in platelets, while a small dose occasions a rise in their number.[4,6,7,10,18,32,33,39] A rise in blood fibrinogen following irradiation has been reported by Saelhof,[31] Stephan,[35] and others (ref. 12, 13 and 16, cited in Dunlap[8]).

OUTLINE OF THE MODIFIED TEST

In a previous communication,[34] details of a proposed modification of the Waugh-Ruddick test are set forth. Therefore, only a brief outline of the test need be presented at this time.

Increasing concentrations of heparin are made in physiological saline, so that 0.1 cc. of saline contains 1/50, 2/50, 3/50 up to 7/50 units of heparin. Seven small test tubes (13 by 100 mm.) containing saline, heparin and calcium chloride are set up as shown in Table 1. Four and one-half cubic

Table I

CONTENTS OF THE TEST TUBES BEFORE THE ADDITION OF PLASMA

Tube	0.9 Per Cent NaCl Containing Heparin		0.01 M Calcium Chloride
1	0.1 cc.	1/50 unit	0.2 cc.
2	0.1	2/50	0.2
3	0.1	3/50	0.2
4	0.1	4/50	0.2
5	0.1	5/50	0.2
6	0.1	6/50	0.2
7	0.1	7/50	0.2

centimeters of blood are drawn by venipuncture and are mixed immediately and thoroughly with 0.5 cc. of 0.1 M sodium oxalate. The blood is centrifuged at 1,000 r.p.m. for five minutes, during which time the seven prepared tubes are placed in a water-bath at 37.5° C. Following centrifugalization, the plasma is removed, and 0.1 cc. is added to each tube. The tubes are corked, agitated gently to insure mixing of the fluid and plasma, and replaced in the water-bath. The time is recorded, and the test begins. Starting after about two and one-half minutes, the first tube is partially removed from the rack and tilted slightly to determine whether coagulation has taken place. If this has not occurred, the tube is gently replaced, and is examined every half minute until clotting has occurred. The time is recorded. This procedure is carried on for each successive tube, and the results are plotted, coagulation time against concentration of heparin.

REPORT OF CASES

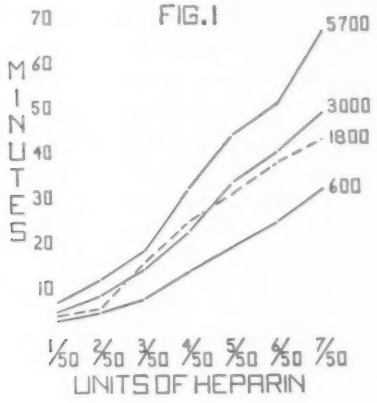
Ten patients, receiving radiation therapy at the Royal Victoria Hospital for various neoplastic conditions, were followed at regular intervals during their treatment, and blood coagulability curves were done after the modified method of Waugh and Ruddick. Each patient received approximately 300 r per day, and the blood was taken one to two hours after treatment. The physical factors involved in giving the radiation were 200 kilovolts at 50 cm. focus-skin distance. For filtration, 1.0 to 2.0 mm. of copper was used. Of the 10 cases studied, only 4 need be described, as these are typical of the whole series.

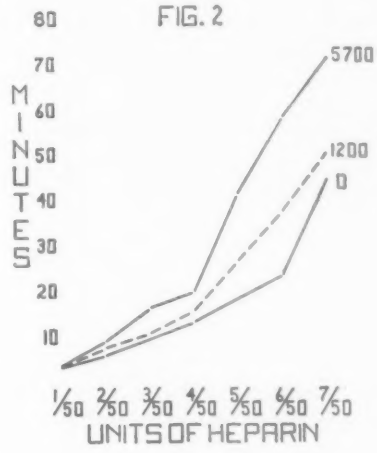
Case 1. Miss M., aged forty-five, was admitted for treatment of carcinoma of the cervix uteri. She received 300 r a day, delivered through two anterior and two posterior fields, so that the entire pelvis was under bombardment. In total, 5,000–6,000 r was delivered to each side. Figure 1 shows some of the curves obtained on this patient. There is a counter-clockwise shift of the curves, indicating decreased coagulability of the blood. The values opposite each curve represent the total irradiation (in roentgens) received at the time of the test. Curves obtained after 5,700 r had been given went off the graph, and are not shown.

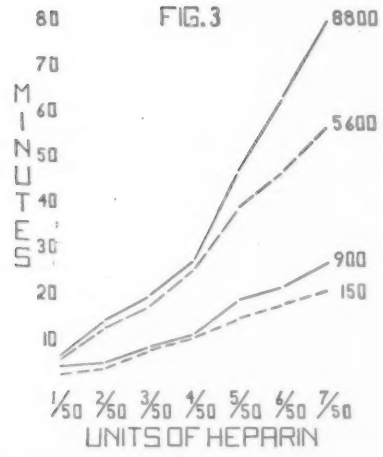
Case 11. Mr. G., aged sixty, entered the hospital for treatment of a lymphoepithelioma of the left tonsil. On admission, there was local extension as well as spread to the left side of the neck. Treatment was therefore concentrated on this side, and a total of 9,000 r (300 r daily) was given. The right side received 5,000 r, both to treat any clinically uninvolved areas on that side as well as to cross-fire the left side. Three fields were employed on each side, covering the neck, nasopharynx and the base of the skull. In Figure 2 are shown some of the coagulability

curves obtained from this patient. Here again, a decreased coagulability of the blood is present, indicated by a counter-clockwise shift of the curves with increasing total dosage in roentgens. No curves obtained with the total radiation dosage above 5,700 r are shown, for these went off the graph.

Case III. Miss D., aged seventeen, was admitted complaining of a painful mass in the left leg. A diagnosis of osteogenic sarcoma was made, and the patient received 14,000 r, through four fields, to the local area. Figure 3 shows the behavior of this patient's blood coagulability. The counter-clockwise rotation of the curves is present, and the decreased coagulability appears to be proportional to the total radiation received at any point during the course of therapy. In this case, the curves did not go off the graph until more than 8,800 r had been given.







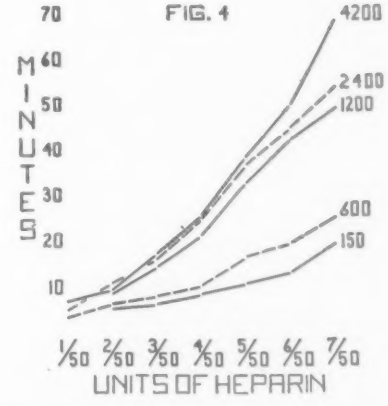


Fig. 1. (The values opposite each curve represent the total irradiation, in roentgens, received at the time of each test; only those tests are shown whose coagulation curves remained entirely on the graph.) Case I. Cancer of the cervix. Total irradiation approximately 12,000 r. Note the counter-clockwise shift of the curves, indicating decreased coagulability of the blood.

Fig. 2. Case II. Lymphoepithelioma of the tonsil. Total irradiation 14,000 r. Decreased coagulability is present, indicated by an anti-clockwise shift of the curves.

Fig. 3. Case III. Osteogenic sarcoma of the leg. Total irradiation 14,000 r. The decreased coagulability appears to be proportional to the total irradiation received at any point during the course of therapy.

Fig. 4. Case IV. Cancer of the cervix. Total irradiation 12,000 r. Note the counter-clockwise shift of the curves, as well as the relation between the height of the curve and the amount of radiation given.

Case iv. Mrs. V., aged fifty-six, received a total of 12,000 r to the pelvis for cancer of the cervix. The anti-clockwise shift of the coagulability curves, and the fact that this shift is roughly proportional to the total radiation dose, are well shown in Figure 4. Above 4,200 r, the curves went off the graph.

DISCUSSION

From the above it is evident that the coagulability of the blood is decreased by irradiation, at least in the doses used in treating neoplastic disease. In 2 of the patients studied, there was a primary increased coagulability when the total dose of radiation was 600 r or lower. However, above this point, all exhibited a decreased coagulability. This is in keeping with the fact that a stimulus may be irritative at one intensity and depressive at another. It also explains, to some degree, the varied results reported in the literature. Those investigators reporting an increased blood coagulability following irradiation for the most part used small doses of radiant energy.[21–24,40] Those reporting a decreased coagulability employed large doses of radiation.[9,17,29,40] Dunlap[8] states that the most important single factor determining the degree of the blood changes and the rate at which they develop is the dose of radiation absorbed by the patient. The greater the dose, the more profound is the blood damage, the more rapidly it develops, and the more slowly it is repaired. There are also individual variations in radiosensitivity which are increased by differences in age or health.

It is stated[8] that the same dose of radiation gives a different degree of blood damage, depending on what part of the body is exposed. Irradiation of the abdomen is found to produce greater changes in the blood than treatment over the chest, head or extremities. These regional differences in the effectiveness of irradiation are greater than can be explained by any differences in the amount of blood or of hemopoietic tissue included in the various fields of treatment. In this series, differences in degree were present, but a decreased coagulability of the blood was obtained regardless of the area stimulated.

A source of confusion has always been the progressive nature of the blood changes following irradiation. Observations made today may be in conflict with tomorrow's findings. Obviously, the complete picture of the coagulability changes can only be obtained by repeated determinations at short intervals during the course of therapy, such as was done in this series.

Accurate measurement of the coagulation time, while highly desirable, is not always easy, due to the many external factors which may affect the process. These include changes in temperature, foreign bodies in the test tubes, air bubbles in the syringe, etc. The Waugh-Ruddick test and its modification, by measuring the coagulation time under controlled conditions, in tubes containing increasing amounts of heparin, allow of seven or eight determinations being made, and even if the reading of a single tube does not fit into the general contour of the curve of the graph, it can be discarded without preventing one from determining whether any abnormality exists.

The decreased coagulability of the blood seen after heavy irradiation is, according to various workers, due to a reduction in plasma prothrombin secondary to liver damage,[15] a reduction in platelets (and thus thromboplastin) due to bone marrow damage,[9,17] and the production of an anticoagulant substance.[1,2] While very little work was done in this series to investigate the cause of the coagulability change, certain remarks in this direction can be made. About thirty prothrombin time determinations were done, using both rabbit brain and Russel viper venom as the source of thromboplastin. In most of the cases, the time was within normal limits. While it is true that severe liver damage will cause a fall in prothrombin, it is also a fact that the percentage of plasma prothrombin has to fall to around 35 per cent of normal before the clotting time is pro-

longed to the extent seen in the above series. It is difficult to see how irradiation of such distant sites as the tonsil and leg could produce sufficient liver damage to reduce that organ's prothrombin production by two-thirds.

Quick[28] states that thromboplastin is the trigger-substance of the coagulation process, and that it initiates and determines the speed of the reaction. A reduction in the thromboplastin factor, either in the plasma or in the platelets, would therefore occasion an increased clotting time. Waugh and Ruddick[38] reduced the platelet count in plasma samples by centrifugalization, and obtained a counter-clockwise shift of the coagulability curves, indicating a prolongation of the coagulation time, similar to that seen following irradiation. Inasmuch as these investigators feel that their test is a measure of available thromboplastin, the findings after irradiation would suggest a reduction in this factor.

Very recently, Allen and his group[1,2] have described an irradiation syndrome in dogs dying as the result of roentgen-ray exposure of 450 roentgens over the entire body. The clotting and bleeding times were markedly prolonged after the sixth day, and the blood failed to clot after the ninth day even through thromboplastin, fibrinogen, prothrombin and calcium were present. The clotting property was restored to normal by the addition of protamine sulphate or toluidine blue, both of which bind and biologically inactivate heparin. Allen *et al.* isolated an amorphous material possessing high anticoagulant properties which seemed "in no way dissimilar from a standard sodium heparin salt." In summary, they felt that the prolonged clotting and bleeding times were due to "the presence in the circulation of an anticoagulant whose properties, as far as tested, were indistinguishable from those of heparin." It will be interesting to learn whether similar conclusions can be drawn from a study of the blood of patients receiving therapeutic doses of radiation. One would hesitate to unreservedly apply the findings obtained in dogs subjected to lethal doses of roentgen rays.

SUMMARY

Using the modified Waugh-Ruddick test, studies of blood coagulation were done on a series of patients receiving radiation therapy for neoplastic disease.

The coagulability was found to be decreased, and this trend was roughly proportional to the total irradiation received.

The possible causes of this change are reviewed.

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Vol. 62, No. 4

EFFECT OF ATROPINE ON ACUTE IRRADIATION SICKNESS IN MICE*

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THE theory that the effect of ionizing radiation is due to liberated histamine-like substances has been advocated. It has also been suggested that the new antihistamine drugs should alleviate this effect. Seven of the antihistamine drugs† were injected into mice, and a slightly greater tolerance to radiation was noted. The antihistamine drugs also have a weak atropine action[3] and in order to determine whether the protection was due to the weak atropine action or the antihistamine action of these drugs, atropine alone was injected. A greater percentage of the mice survived when atropine alone was used than when the antihistamine drugs were used. The slight protection given by the antihistamine drugs is apparently due to their weak atropine action.

PROCEDURE

Albino Swiss female mice were obtained from Carworth C F_1 strain throughout the past year. They varied from 18 to 22 grams in weight. In order to equalize this variation in weight, since the larger mice have greater tolerance to radiation, the mice were divided between control and irradiated groups according to weight.[4] The mice were kept in a constant temperature animal room and fed the usual "dog chow" diet. No supplementary vitamins were added to the diet.

The mice were irradiated in groups of 10 in a circular chamber covered with cellophane. The backscattering from the table top was approximately 10 per cent. A 200 kv., 20 ma. General Electric therapy unit was used. A 1 mm. Al filter was added to the inherent filter of the oil-cooled tube. The distance from target to chamber was 30 cm. Under these conditions the output was quite high and averaged 192 roentgens per minute. The high irradiation rate accounts for the lower survival rate than is at times given in the literature.[2] A Victoreen 100 r chamber checked against a 3.33 mg. radium needle was used as a standard throughout the year. The atropinized and control mice were always exposed the same day, and under identical conditions. Care was taken to prevent crowding in the irradiation cage.

The mice were injected intramuscularly by using 0.1 cc. of a 0.45×10^{-3}M. solution of atropine sulfate in normal saline. The outside of the thigh was used for the injections. This site seemed to produce the least damage to the mice. These few mice which died a few minutes after a reinjection were not considered in the statistics as they undoubtedly were killed by the trauma of the injection. The injections were given daily beginning twenty-four hours before irradiation and continued until the fifteenth day. No variation of this dose was used. The weights were kept, and the loss of weight was quite uniform in the control group, but a much smaller percentage of the treated mice lost weight. The typical signs of acute irradiation sickness were observed in all control mice. There was a decrease in their fluid and solid intake, they soon lost their sleek appearance, and a few days before dying were so weak and emaciated they were unable to feed themselves. In the treated groups the symptoms were not noted so early. However, mice which showed no evidence of severe irradiation sickness on one day, were often found dead on the following day.

† Benadryl, pyribenzamine, antistine, transetine, thephorin, Nu-1326, Nu-1525.

* This work was supported by the Connecticut Cancer Society.

RESULTS

In order to demonstrate statistically the atropine effect on irradiated mice they were considered to survive if they were still alive on the eighteenth day. This was three days after medication was stopped, and all pharmacological action of atropine dissipated. By the eighteenth day almost all the irradiated mice which had received a lethal dose died. The treated mice died as late as the thirty-fifth day, and a greater

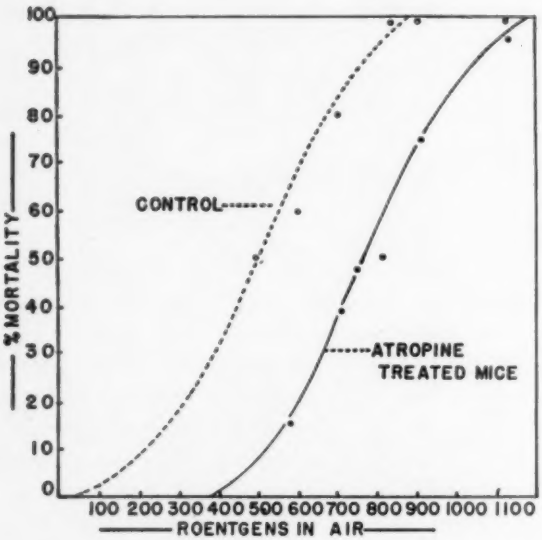

Fig. 1. Survival curves on eighteenth day. There is 250 r difference between the curves of the control and atropinized mice.

percentage of them died after the eighteenth day when the drug was discontinued. It is not known whether they would have lived had the drug been continued after the eighteenth day.

The results of the 104 control mice are shown in Figure 1, broken line. The curve is the typical "S" probability curve, and agrees quite well with the usual survival curves for mice found in the literature.[1] At approximately 600 r 60 per cent of the controls were dead by the eighteenth day. As the groups received larger amounts of radiation fewer survived. The three groups receiving more than 740 r all died.

The mice receiving a daily dose of atropine also received more radiation, which they must tolerate if the drug is to be effective. There were 106 mice in this group. In spite of the definite protection given to a majority of the mice it had no effect in a small percentage, and these treated mice died as early as the controls. However, in the central portions of the survival curves (Fig. 1) where lethal doses are given, and where there is not so much radiation given that the effect of the atropine is no longer present, there is an unquestionable difference in the mortality of control and treated mice. When the radiation exceeded 910 r the treated groups failed to survive.

The average survival time for the groups receiving absolute lethal amounts of radiation (1,152 r) is shown in Figure 2. Forty-four mice in the control group lived five days and only 1 more than eleven days. In the treated group the average was twelve days and 1 animal survived more than thirty-five days. Thus even when lethal

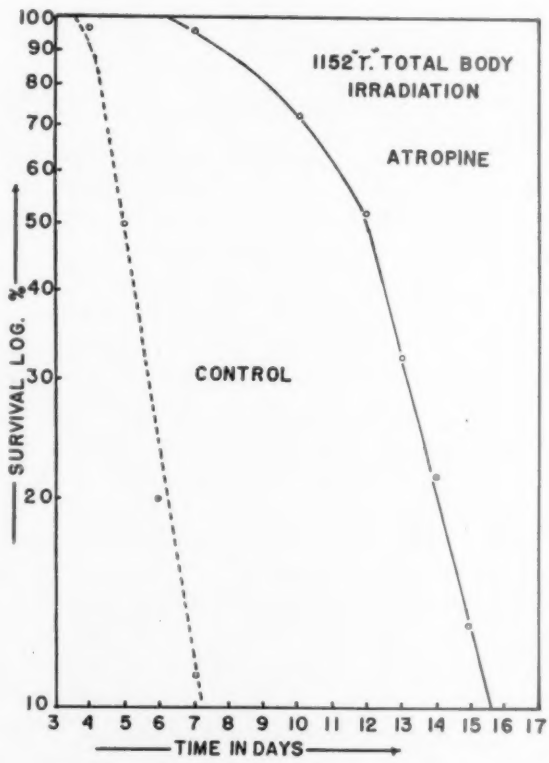

Fig. 2. The atropinized mice average survival time was twelve days, while the control group averaged five days. A single mouse survived 1,152 r.

doses were given, the survival time was almost twice that of the controls, and atropine produced an effect on irradiation sickness.

COMMENT

The finding that the autonomic blocking agent, atropine, will affect irradiation sickness suggests another ionizing radiation reaction. Atropine competes with acetylcholine, and overcomes its pharmacological action by preventing acetylcholine from entering effector cells. When the atropine increases the resistance of the mice to radiation it may be affecting the function of almost any organ, so the protecting mechanism is not known.

SUMMARY AND CONCLUSIONS

1. Atropine in dosages of 0.1 cc. of a 0.45×10^{-3}M. solution when injected daily has an effect on the survival of mice receiving roentgen radiation.

2. The increase in survival rate is shown to be greater than would be expected by chance. It is necessary to give 250 r more to the treated mice to produce the same per cent mortality as the controls.

3. When 1,152 r was given neither the treated nor control mice survived. However the average survival time for the control group was five days while the treated mice lived twelve days. Thus even when an absolute lethal dose was given atropine still has an effect.

4. Atropine given at other time intervals or a different dose was not investigated. None of the other autonomic blocking agents were tried.

5. Ionizing radiation must produce multiple injurious reactions. The particular reaction that atropine produces is not the most important, as the protection is incomplete.

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THE TIME FACTOR IN LETHAL EFFECTS OF TOTAL ROENTGEN IRRADIATION IN TRITON

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THE problem of dose distribution in time is one of the most important problems in the field of radiotherapy. There are in roentgen therapy two conflicting opinions. According to one of them the so-called "time factor" plays a significant role in the final results of irradiation (Holthusen,[1] Zuppinger,[2] Regaud and Ferroux,[3] Jüngling and Langendorff,[4] Zwerg,[5] Sax,[6] Motida and Adati,[7] Bauer,[8] Lea,[9] Ellinger,[10] Lasnitzki,[11] Hueper and de Carvajal-Forero,[12] Lavedan,[13] Sax,[14] and others). The Coutard method of protracted fractionated roentgen therapy as well as Frankfort's and other similar methods are based on the acknowledgment of the importance of the time factor. The adherents of the second opinion ascribe very little or no significance to the dose rate factor (Abele,[15] Herčik and Machek,[16] Langendorff,[17] Fano and Demerec,[18] and others).

It is the task of experimental roentgen biology to determine which of these two concepts is correct. This problem can be clarified only by large and numerous experiments involving not one but many species and extending the observations to all the observable effects on all the life processes that it is possible to investigate.

The purpose of the present investigation was to study the effect of total body irradiation of adult tritons (*Triton cristatus*, Amphibia, Urodela) with a definite dose of roentgen radiation differentially distributed with respect to time.

Table I

Experimental Group	I	II	III	IV
Duration of treatment period (in days)	23	23	22	1
Number of treatments	20	20	4	1
Dose given during every treatment (in r)	150	150	750	3000
Target-object distance (in cm.)	25	112	25	25
Duration of every treatment	5.1 min.	102.3 min.	25.5 min.	102 min.
Summarized time of treatment	1 hr., 42 min.	34 hr., 6 min.	1 hr., 42 min.	1 hr., 42 min.

Table II

Experimental group	I	II	III	IV
Duration of treatment period (in days)	23	23	22	1
Number of treatments	20	20	4	1
Dose given during every treatment (in r)	100	100	500	2000
Target-object distance (in cm.)	25	112	25	25
Duration of every treatment	3.4 min.	68.2 min.	17 min.	68 min.
Summarized time of treatment	1 hr., 8 min.	22 hr., 44 min.	1 hr., 8 min.	1 hr., 8 min.

The conditions of the irradiation were as follows: 120 kv. max., 3 ma., filter 3 mm. Al. The target-object distance varied in different experiments (see Tables I and II). During the time of the irradiation the treated group of animals (20 or 22 specimens) was placed in a wooden box (15 by 15 by 3 cm.) which was covered with gauze to keep the animals inside. The bottom of the box was

covered with wet cotton to prevent the drying of the animals. Two series of experiments were performed. Each series involved four experimental groups and one control group.

Each group of the first series consisted of 20 animals. All treated animals were given 3,000 r. These experiments were started on June 13. The dosages, time intervals and other factors of the roentgen treatments in these experiments are given in Table 1.

effect with the dosage given. Furthermore, it is a well known fact that in the laboratory the Amphibia are extremely sensitive to all external factors and are especially affected by high temperatures. In these experiments performed during the summer months such high temperatures were observed. These early deaths of these most sensitive animals in groups I and II were probably related to the combined effect of high temperatures aggravated by the dis-

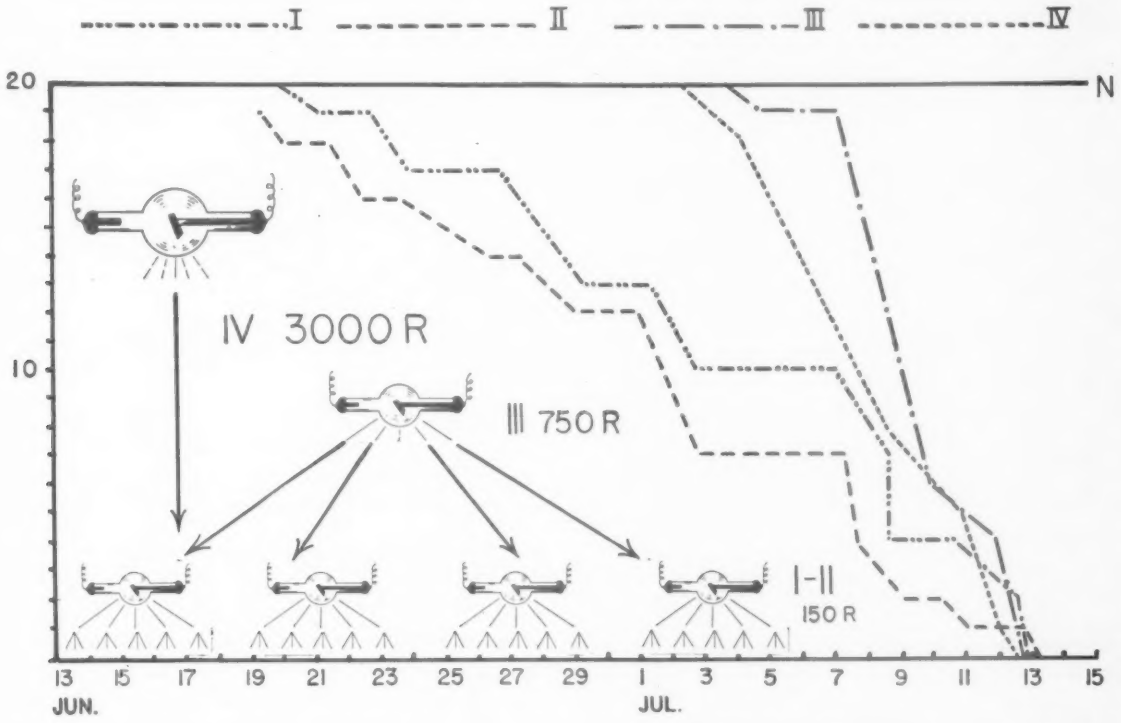

Fig. 1. The results of the first series of experiments. Ordinates: number of animals. Abscissas: period of observation. The roentgen tubes symbolize the time of the irradiations. Continuous line (*N*) refers to the control animal group. Differently dotted lines refer to the treated animal groups.

The results of this series of experiments are shown in Figure 1. The animals in groups I and II began to die gradually after a few daily doses had been given. It was thought that their death was caused not only by the roentgen treatment but appeared to be influenced by other factors, as the dose applied during this time was probably not large enough to cause their death in such a short time interval. It is also improbable that this short interval was long enough to be a latent period for a lethal

turbance of the daily exposure to the heated roentgen tube and the superimposed effect of the comparatively small doses of roentgen radiation. All the animals of groups I and II died within an interval of twenty-five days, while the death of the animals in the other two groups, III and IV, occurred during a nine to eleven day period. The results of these experiments show that the length of the maximum survival period was the same for all four groups. It may be observed from Figure 1 that while animals of

groups I and II began to die earlier and more gradually, all the animals of the four treated groups died within thirty days after the first irradiation. None of the control animals died during this period. Obviously the dose of 3,000 r administered under the existing conditions was a dose large enough to shorten the life of the treated tritons to one month.

The second series of experiments, as was said above, involved also four experimental groups and one control group. All treated animals were given 2,000 r. Each group consisted of 22 animals. These irradiation experiments were started on September 9. The dosages, time intervals and other factors of the radiation treatments in these experiments, are given in Table II.

A comparison of the reactions of the animals of both series revealed that the animals in this second experiment responded more uniformly and harmoniously to the dose of 2,000 r even though this was administered in varying amounts and at different time intervals. Only a few animals of groups I and IV died relatively early in the experiment. The animals began to die in numbers approximately one month and a half after the beginning of the irradiation, and they continued to die for approximately three weeks until all the animals had succumbed. As observed in the first series, near the end of the experiment the death of a number of the remaining animals of all four experimental groups occurred at about the same time. Only two control animals died during the experimental period.

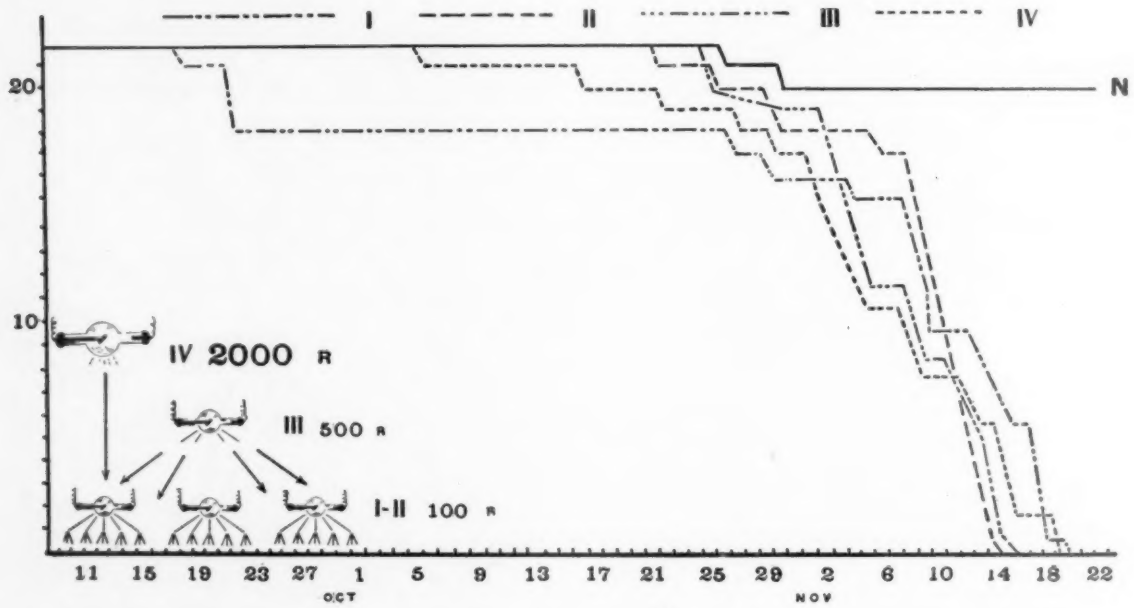

FIG. 2. The results of the second series of experiments. The key see Figure 1. In this figure only fifteen treatments are shown for groups I and II. The animals in these groups actually received twenty radiation treatments as indicated in Table II. The five irradiation periods had to be omitted from this chart in order to conform to twenty days on the time scale.

On the basis of these results the following conclusion may be drawn: The dose of 2,000 r caused the death of all treated tritons in two and a half months. It occurred despite the fact that some of them received this dose either protractedly, fractionally or in a single dose. Identical effects were observed if the whole dose was given during one treatment which lasted sixty-eight minutes or, if it was fractionated, in four or twenty treatments separated from each other by one week and

one day periods, and finally if each of twenty treatments lasting 68.2 minutes protracted the time exposure to twenty-two hours and forty-four minutes.

For the solution of the problem at hand the second series of experiments has advantages in two respects. First, the temperature conditions did not complicate this experiment. Second, the smaller dose, 2,000 r, did not produce a lethal effect so promptly, thereby allowing sufficient time for all the differently treated animal groups to show the possible differences in their reactions. Yet a more uniform rate of death of the experimental animals in all four groups testified to the fact that the lethal effect of the dose of 2,000 r total body roentgen irradiation in *Triton cristatus* was the same, regardless of how it was given.

It is valuable to compare these results with those obtained by Magath in mice (personal communication). A dose of 1,000 r during a single treatment caused the death of all treated mice soon after the irradiation. The same dose when divided into twenty parts and given during twenty days did not have a lethal effect. These results suggest that these two kinds of animals (triton and mouse) differ from each other in regard to the cumulative effect of roentgen radiation. The cumulative effect is most pronounced in tritons and therefore they reacted similarly to all the different methods of treatment. In mice the cumulative effect was not observed obviously as the dose administered in parts did not kill the mice as the single one did.

The results of this investigation point out once more the necessity of exercising great discretion in evaluating and transferring the conclusions regarding the biological effects of roentgen rays determined on the basis of the treatment of one kind of experimental animal to another. This can be illustrated by the fact that not only the distantly related organisms such as vertebrates and invertebrates react in a very different manner to the same treatment but even more closely related animals such as the mouse and the guinea pig differ strongly in their reaction to the same dose of roentgen rays. The lethal dose for the mouse is 1,200 r, while for the guinea pig it is only 500 r (Ellinger[19]; see also Clark[20] and Henshaw[21]).

SUMMARY

The lethal effect of total body roentgen irradiation on adult tritons (*Triton cristatus*) is not dependent on the distribution of the dose in time. Obviously the triton is one of the animals which accumulates the small doses given during many days of protracted or fractionated treatment.

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Vol. 62, No. 4

BIOLOGICAL EVALUATION OF 20 MILLION VOLT ROENTGEN RAYS*†

III. RECESSIVE SEX-LINKED LETHALS IN *DROSOPHILA MELANOGASTER*

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THE connections between the quality of a radiation and its biological effectiveness are partly understood. If it is known how two kinds of radiation compare with respect to one biological reaction, one can predict, with a moderate degree of confidence, how they will compare with respect to another reaction of a similar nature. However, if one were to extend such predictions to biological reactions of a very different nature, he would be on very uncertain ground. Hence, in order to obtain a general idea of biological effects of any given radiation, it is necessary to test it over a wide range of reactions; and it is less important to have very many reactions than to have very diversified ones.

We are endeavoring to evaluate the biological effects of high energy roentgen rays produced by the betatron at 20 mev. Two reactions previously reported[1,2] were a general and a local reaction of a mammal. We now add a local reaction in an insect: The production of recessive sex-linked lethals in the sperm of *Drosophila melanogaster*. This reaction has been widely tested before.[3] It seems to occur whenever one ionization takes place within a target area of about 20 mμ. diameter. It is known that it is almost insensitive to changes of quality: no significant differences were found in the effects of soft and hard roentgen rays, beta and gamma rays. Neutrons are about two-thirds as effective as roentgen rays, for equal amounts of energy absorbed. Wide variations in the rate of delivery have little, if any, influence on the effect. Details of the experimental technique (for instance, the age of the sperm allowed to fertilize ova) have some influence on the results, and there is some discrepancy among numerical values obtained by different observers. But the results obtained in any single laboratory are quite consistent.[3]

The mutagenic effect of radiations certainly belongs in any general testing program. For quantitative comparisons, mutation rates are converted into m, the mutation rate per 1,000 r.* Unfortunately, precise determinations of m are to be had only at the expense of a very considerable amount of work. If the dose administered was exactly 1,000 r, then m (in per cent) equals the percentage of sex-linked lethals, and its variance is given by the well known formula:

$$(1) \qquad \text{Var}\ (m) = m(100 - m)/N$$

where N is the number of chromosomes tested, after irradiation with 1,000 r. As m is less than 3 per cent, $(100 - m)$ differs little from 100, and the variance of m is about equal to $100\ m/N$. If the dose applied is k times 1,000 r, then the percentage of mutants is about k times m, and its variance equal to $k\,m(100 - k\,m)/N$. For the reaction range which can be used experimentally, $(100 - km)$ does not differ greatly from 100. Thus we find that, independent from the test dose applied,

$$(2) \qquad \text{Var}\ (m) \simeq 100\ m/N.$$

Suppose one wanted to determine a muta-

* Like most authors we are using the term "mutation rate" for the more correct but lengthy expression "rate of production of recessive sex-linked lethals." The justification of the term lies in the assumption that most mutations are recessive lethals, and that most recessive lethals are mutations.

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† This investigation was supported in part by a research grant from the National Cancer Institute of the National Institute of Health, United States Public Health Service.

tion rate within 10 per cent with a 95 per cent reliability. Mutation rates being about 2 per cent, this means that the standard deviation of m should be not more than one-half of 10 per cent of 2, or the variance not more than 0.01. This can be obtained by making N sufficiently large. Substituting 0.01 for Var(m) in formula (2), one finds N equal to about 20,000. This represents about 3,500 hours of work.

We did not plan our *Drosophila* tests on a scale sufficiently large to obtain a precise determination of the relative effectiveness of the betatron high energy roentgen rays. We used a total of 5,289 chromosomes, which was sufficient to see whether mutation rate measurements yield results compatible with those obtained in previous tests with other reactions.

MATERIAL AND METHODS

The C*l*B test devised by H. J. Muller was used for the detection of the sex-linked lethals induced by roentgen rays. The test stocks, both of which were obtained from the Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, New York, chosen were ec ct^6 s car/ C*l*B and g^2pl/ C*l*B. The procedure followed was to treat 50–100 males, placed in size oo gelatin capsules, of each stock with roentgen rays from the various sources, and then mate these treated males to virgin C*l*B females of the opposite stock. The F_1 C*l*B females were then mated in single female by several males matings in 8 dram shell vials. The males used in the F_1 matings were usually from the same stock as the original treated males.

In the examination of the offspring of the F_1 C*l*B females for lethals, only those vials in which a lethal had obviously occurred were classified as such. If there were any doubt due to small numbers of offspring or to the appearance of a few males, any proportion greater than 1 male to 50 females, such vials were classified as semi-sterile. An accurate count was also kept of the number of sterile vials. Although visible mutations induced by the roentgen rays appeared in our tests no attention was given to these.

For the irradiations, three machines were used: the betatron, and conventional machines for deep and superficial therapy. For irradiations on the betatron, we built a phantom of sheets of presdwood, of such dimensions that if fitted into the space between the coilboxes. A channel in this phantom was aligned with the central ray. The target-near end of the channel was closed with a presdwood plug 6 cm. long, to insure the building up of electronic equilibrium. A Victoreen condenser thimble chamber was introduced into the channel, and a monitor instrument outside the phantom was calibrated against it. By substituting the flies for the thimble in the phantom, the doses administered to them could be accurately determined from the readings of the monitor. The dosage rates differed from experiment to experiment but were always of the order of several 100 r/min. For irradiation at 200 kv., the flies were placed into a cell in a large block of presdwood. The dosage rate was 100 r/min. For irradiation with 100 kv., the flies were placed upon a paraffin block near the target. The dosage rate was 1,600 r/min.

RESULTS

The results obtained are shown in Table 1. One sees that some results seem to be quite out of line, especially the betatron figures in Experiment No. 2. However, the total variability is about as expected.

Analyses of variance were performed with respect to several factors which could be suspected to influence the results. A negative result, i.e., no significant effect upon the mutation rates, was found for the following factors: single experiments vs. total average, high vs. low dosage level, strain ec ct^6 s car vs. g^2 pl. This leaves technique of irradiation as a potentially significant factor. The following weighed averages were calculated: betatron: $m = 1.4$ with a standard deviation of ± 0.3; 200 kv.: 2.5 ± 0.4; 100 kv.: 1.6 ± 0.4. The difference between the two low energy

TABLE I

EXPERIMENTAL RESULTS

Experiment No. and Date	Machine	Dose in r 10^{-3}	Strain ec ct^6 s car				Strain g^2 pl			
			No. chromosomes tested	No. fertile	No. fertile without males	m	No. chromosomes	No. fertile	No. fertile without males	m
1 Jan. 10, 1947	betatron	1.755	124	118	4	2.0	136	133	6	2.6
		2.94	135	132	12	3.2	132	121	8	2.3
	superficial	3.3	127	117	5	1.3	130	118	9	2.4
	deep	2.84	135	134	13	3.6	129	122	9	2.7
	—	0	137	137	0	—	135	130	0	—
2 May 14, 1947	—	0	105	100	0	—	105	103	0	—
	betatron	3.01	109	95	2	0.7	110	101	2	0.7
		6.02	110	93	10	1.9	106	90	4	0.7
	deep	3.0	103	89	10	4.0	110	103	7	2.3
		6.0	53	43	13	6.0	111	75	8	1.9
	superficial	3.0	119	98	10	3.6	110	92	3	1.1
		6.0	48	15	2	2.4	89	61	6	1.5
3 Nov. 12, 1947	—	0	104	100	0	—	105	98	0	—
	betatron	2.30	119	113	8	3.2	120	94	3	1.4
		4.70	119	109	11	2.3	120	97	8	1.8
	deep	3.16	120	106	9	2.8	120	106	12	3.8
		6.32	105	88	7	1.3	121	91	11	2.3
	superficial	3.25	120	114	5	1.4	124	113	7	2.0
		6.52	54	50	2	0.6	57	45	6	2.2
4 Jan. 31, 1948	betatron	2.98	84	78	4	1.8	129	125	9	1.4
		5.9	66	64	7	1.9	36	28	5	3.3
	deep	3.16	83	82	4	1.6	113	109	7	2.1
		6.32	84	74	10	2.3	105	93	13	2.4
	superficial	3.75	123	122	6	1.3	119	114	10	2.5
		7.5	35	33	5	2.2	94	78	10	1.8

machines is not necessarily significant; a difference of this size might be expected, on the basis of random sampling, about once in eight tests. In this respect it compares to published results about effects of quality and dosage rate; the material published does not prove the presence of quality and dosage rate effects, but it certainly does not exclude them either.

The weighed average mutation rate per 1,000 r, for the two low energy machines combined, is 2.0 ± 0.3, or 0.6 ± 0.4 larger than that for the betatron. Again, the difference is not significant; it would occur,

by chance, in one test out of six. However, in this case we have no reason to believe that the factor should be equal to 1.0. Hence, we take the figures as they stand as the best estimate, which means that 1 r as measured in the betatron beam by a 25 r Victoreen condenser chamber, has the mutagenic effect of roughly 0.7 r of conventional rays. No great precision is claimed for this factor.

DISCUSSION

The induction of sex-linked recessive lethals is the third biological test reaction we have used to compare the biological effectiveness of high energy and low energy roentgen rays. As in the previous tests, it was found that high energy rays are less effective per unit dose as read by a physical instrument. The factor found this time is 70 per cent, as compared to 72 per cent found in testing the decoloration of hair in mice, and to 79 per cent obtained with survival time of mice after total body irradiation. The factors found are similar, possibly identical. We have pointed out before that the nature of this conversion factor can be determined only if an absolute measurement of high energy rays is performed. Such an absolute measurement implies a re-definition of dosage units. The arbitrariness of the 25 r thimble as a standard is shown by the fact that thimbles of different capacity (25 r, 100 r, 250 r), properly standardized for rays of conventional energies, give discordant readings in the betatron beam—the smaller the chamber, the higher it reads in the betatron beam.

SUMMARY

1. The mutagenic effect of roentgen rays has been investigated by means of the C/B test in *Drosophila melanogaster*. Three types of apparatus were used: the betatron, and conventional machines for deep and superficial therapy.

2. The results obtained are consistent with an effectiveness of 70 per cent of the high energy rays, as compared to low energy rays, both referred to the 25 r condenser thimble as the common standard.

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Vol. 62, No. 4

RADIATION EFFECTS ON 2, 3, 5-TRIPHENYLTETRAZOLIUM CHLORIDE SOLUTIONS

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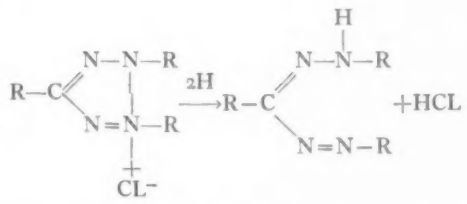
I. INTRODUCTION

2, 3, 5 - Triphenyltetrazolium chloride (TTC) was first synthesized in 1894 by von Pechmann and Runge.[11] Kuhn and coworkers[6,7] took up the study in 1941 and reported, among other properties, its oxidation reduction potential, namely, −0.08 volt in the pH range 5.7 to 6.8. Attention to this substance in America was brought about by the work of Dutcher[4] who reviewed the work of Lakon[8] on topographical staining and analysis of grain seed. Porter, Durrell and Romm[12] also reported on its use as an indicator of seed viability. Cottrell[3] confirmed Lakon's work in 1947, as did also Shuel.[15] Mattson, Jensen and Dutcher[10] used it as a test reagent for checking vitality of tissues other than seeds. Waugh[19] then used this salt as a stain for living stem tissue and leaves. Pratt, Dufrenoy and Pickering[13] proposed it as a reagent in cellular physiology. Straus, Cheronis and Straus[18] were the first to explore its uses in animal tissue, both normal and malignant.

According to the above published works, the formula for TTC and its reduced state is:



Because of its low reduction potential, this colorless water soluble tetrazol is easily reduced by chemical as well as phytochemical means to its red, water-insoluble, nondiffusible formazan.

Noticing that ultraviolet light influenced solutions of this salt, it was believed important to explore this phenomenon further, not only studying light, but also other radiations.

II. EXPERIMENTAL

A. *Methods and Procedures.*

1. Photochemical Investigations. The first investigations into the effect of ultraviolet light on TTC were started with fluorescence equipment assembled for work with fluorescent vital stains. It consisted of an ordinary microscope, ultraviolet light source and eye protective filter. Illumination source was a Leitz carbon arc lamp with a Beckman B-2 and B-4 filter combination. The eye protective filter was a Wratten K-3 located in the eyepiece. To obtain better efficiency, the standard microscope mirror was replaced by an aluminized front surface mirror.

Doing vital staining work with *Allium cepa* epidermis and modern fluorochromes, TTC was also included in the investigations. It was noted that a section of living onion epidermis subjected to TTC solution became pink. This was expected according to the published work. However, while observing this preparation in the fluorescence equipment, it developed in addition to the normal pink color, a bright red spot. To be certain that this was not due to a possible stimulation of cellular activity, a clear drop of TTC solution was placed on a glass slide and observed under identical conditions. Here also, the red precipitate was formed. With the formation of the red spot, fluorescence appeared in the field and increased in intensity to saturation during the observation period.

In systematic investigations, the nature of the red precipitate was determined, also the effective reduction wavelength, the effect of temperature, pH, concentration, intensity of light and exposure time. For

these purposes, aqueous TTC solutions and TTC gelatin emulsions of known concentration, as noted in graphs, were prepared. The chemical was dissolved in distilled water with the pH normally adjusted to 6.0 with phosphate buffer; for special investigations, solutions with pH ranges from 1.3 to 11.0 were prepared. The TTC emulsions contained in general 10 per cent gelatin and 1 per cent TTC.*

A series of varying exposures under standard irradiation conditions was made. Samples were exposed in the appropriate cuvettes and also as emulsions on 4 by 5 inch glass plates. Density measurements of the cuvettes were made in a Beckman quartz spectrophotometer. The density measurements of the plates were made with a Weston densitometer and later with the self-recording General Electric spectrophotometer. This instrument was also used to identify the photochemically produced red substance with chemically reduced TTC (zinc-reduction) by comparing the absorption spectra. Irradiation sources were the sun, the Hanovia U-burner and the Hanovia Alpine lamp. For studying the effective wavelengths, the above sources were filtered by Corning or Wratten filters. Filters with sharp cutoffs or monochromats were especially useful. The results obtained were later verified by exposure of gelatin emulsion plates in the large Littrow quartz spectrograph using, for slit illumination, either National Super-Tan carbons or the Hanovia Alpine mercury lamp. The exposure times were variable up to six hours.

2. Radiochemical Investigations. This work was extended from the photochemical into the radiochemical regions. Both alpha rays and roentgen rays were investigated.

For the alpha-ray work, three polonium preparations were available.† The polonium was deposited on nickel foil 5 by 5 sq. mm. in size. Their strength as of August 23, 1948, was: Preparation No. 1—2 millicuries; Preparation No. 2—0.1 millicurie; Preparation No. 3—0.0004 millicurie.

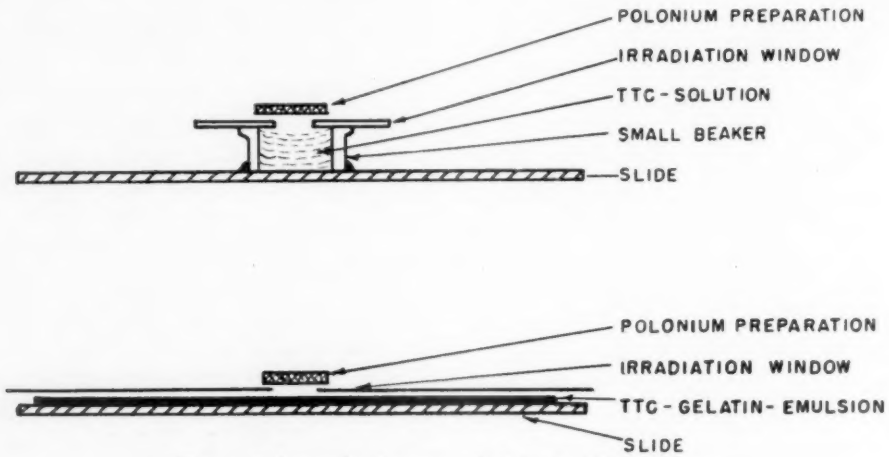


Fig. 1. Schematic diagram of alpha irradiation setup.

Solutions and emulsions of the same concentration as used in the photochemical work were also taken in this study. The alpha-ray bombardment was made in such a way as to capture the maximum energy of the alpha particles in the preparation. Details are shown in Figure 1.

The density of the alpha-particle-produced formazan in the plates was measured with the Weston densitometer.

The roentgen-ray exposures were carried out with aqueous TTC solutions and TTC emulsions that were sealed in small vials of

* TTC from 2 sources: was used: (1) The Arapahoe Chemical Co., Inc., Boulder, Colorado; and (2) The Pannone Chemical Company, Farmington, Connecticut.

† Obtained from Canadian Radium and Uranium Corporation, 630 Fifth Ave., New York 20, N. Y.

3 cc. each. These samples were exposed at a rate of 250 r per minute measured in air and up to 130 minutes total irradiation time. The irradiation was done with 550 kv. roentgen rays through a composite filter equivalent to 9 mm. of copper.

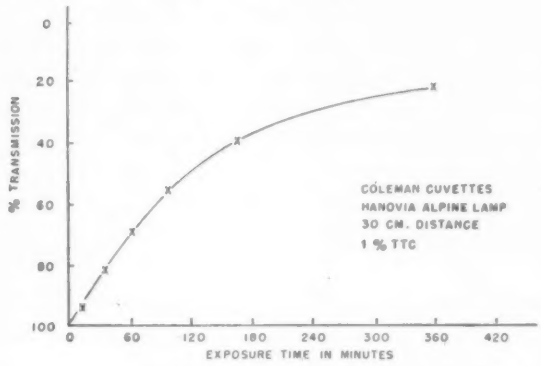


Fig. 2. Reduction of TTC solution by ultraviolet light.

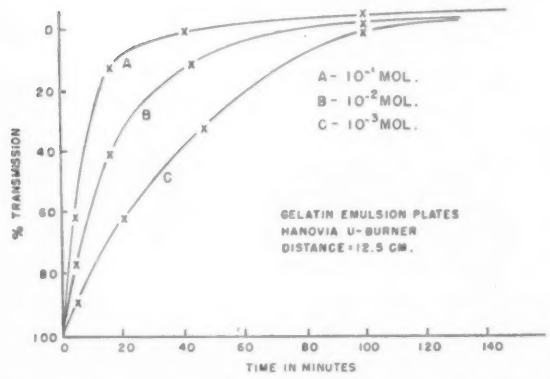


Fig. 3. Reduction of TTC solution by ultraviolet light: Effect of concentration.

B. *Results.*

The following results were observed:

1. By irradiating aqueous solutions of the clear, water-soluble 2,3,5-triphenyltetrazolium chloride with ultraviolet light, this chemical was reduced to its red water-insoluble formazan.

2. The reduction depends on the radiation wavelengths. Wavelengths longer than 3,650 Å do not reduce, whereas wavelengths between 3,650 Å and 2,536 Å reduce effectively. The 2,536 Å region was the lowest at our disposal.

3. The amount of formed precipitate is determined by the intensity of the light source, and/or the time of exposure. Figure 2 shows that graduated exposures give an increasing density.

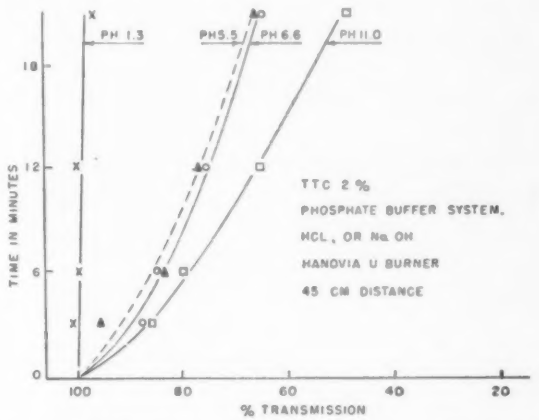


Fig. 4. Reduction of TTC solution by ultraviolet light: Effect of pH.

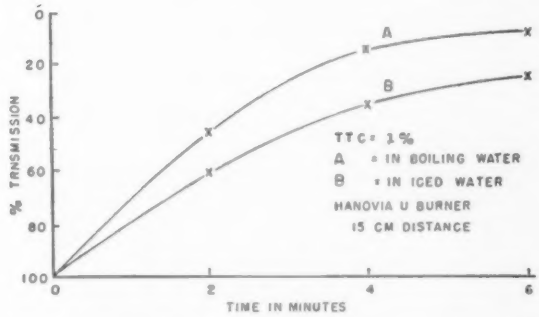


Fig. 5. Reduction of TTC solution by ultraviolet light: Effect of temperature.

4. The rate of formation of the red precipitate increases with increase of concentration. The radiation effects are more pronounced in the early time intervals as shown in Figure 3.

5. The pH influence, noticed early by Jerchel and Möhle,[6] also exists in irradiation reduction. The reduction rate is the same in pH range 5.5 to 6.6 where also the reduction potential is constant (see Fig. 4).

6. Higher temperatures accelerate the reduction process. For example, with a temperature difference of 100° C. (0°–100° C.) and at a two minute irradiation under the chosen standard conditions, there is 15 per cent difference in transmission (see Fig. 5).

7. Alpha rays from polonium sources behave in a manner similar to ultraviolet light. Also here, tetrazolium in aqueous solution or in a gelatin emulsion is reduced to red formazan. The millicurie strength, the exposure time and the concentration of the tetrazolium are significant (see Fig. 6).

8. Roentgen rays also reduce TTC solutions. The amounts necessary are relatively

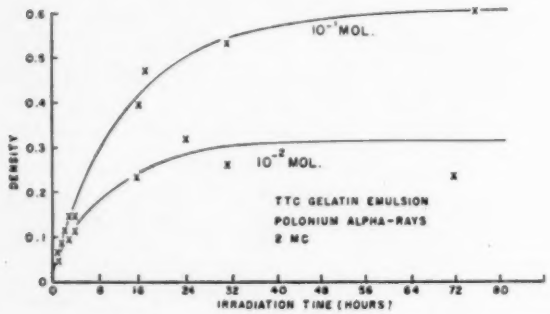


Fig. 6. Reduction of TTC solution by alpha rays from polonium.

high. The earliest visual effect was produced by 32,000 r measured in air.

III. DISCUSSION

The observed results raise the question as to the mechanism of these effects.

TTC is reduced, according to chemical knowledge, by taking up hydrogen atoms. Consequently, hydrogen atoms must be produced by irradiation.

That ionizing radiation converts water molecules into free hydrogen atoms and hydroxyl radicals has been postulated by the theory of Weiss.[20] According to Weiss, in the irradiation of water, the following electron transfers occur:

$$H^+ \; OH^- + \text{Radiation} \longrightarrow H + OH$$
$$H_2O \cdots H_2O + \text{Radiation} \longrightarrow H_2O^- \cdots H_2O^+$$

followed by:

$$H_2O^- \longrightarrow H + OH^-$$
$$H_2O^+ \longrightarrow H^+ + OH$$

All of these processes are energetically possible and have been confirmed independently by photochemical evidence.

The produced hydrogen atoms and hydroxyl radicals are chemically very reactive[5,21] and if there are in the solution appropriate acceptors, they will react with these radiation products. Since biological systems are primarily solutions, the radiobiological implications of the above statements become apparent. So, for instance, dissolved oxygen in water is such an acceptor and irradiation leads to the production of H_2O_2. Such an acceptor, favored by the low reduction potential, must be also tetrazolium chloride.

The production of the effect by ultraviolet light with wavelengths up to 3,650 Å requires further investigation. It may be explained by a direct effect on TTC, so that similar to photosynthetic processes (Rabinowitch[14]) excited intermediate states are formed (Rossi[14a]). The observed fluorescence, which increases with the irradiation time, favors this hypothesis.

There may also be an explanation on the basis of the data given by Lea. According to Lea,[9] 5 electron volts (ev.) are required to convert water into H and OH radicals. The wavelength 2,536 Å has a quantum energy of 4.89 ev. an amount close to the number given by Lea, but very dissimilar to the known water dissociation energy of about 13 ev.[16] Further investigations, especially into the ionic yield, will give additional data and also new insight as to the parallelism between photochemical and radiochemical effects.

To a certain degree, these results and this discussion of the photochemical and radiochemical behavior of TTC solutions are a further contribution to the theory of Weiss on the effects of radiation on water and aqueous solutions as it has been discussed and used by Lea[9] and at the conference in London on "Certain Aspects of the Action of Radiation on Living Cells,"[17] and by Barron[2] at the Forty-Ninth Annual Meeting of the American Roentgen Ray Society, 1948.

IV. SUMMARY

Previous investigations have shown that TTC solution can be reduced chemically.

These experiments show that this substance can also be reduced by photochemical and radiochemical means.

Factors influencing this reduction, such as tetrazolium concentration, intensity of radiation, time of exposure, pH and temperature, were investigated. It is believed that this study is an experimental contribution to the theory of Weiss on the radiochemistry of aqueous solutions.

Following this exploratory work more extensive studies should be undertaken as to different types of radiation, amounts of each necessary to reduce tetrazolium, and especially as to exact ionic yield.

Other substituted tetrazolium salts such as neotetrazolium[1] and 2,3 diphenyl-5 methyl-tetrazolium should be studied as to their radiochemical behavior.

We wish to express our gratitude to Kenneth E. Corrigan, Ph.D. of Harper Hospital, Detroit, Michigan, who carried out the roentgen irradiation for us; also, to Dr. Hans F. Jensen of this laboratory for advice and encouragement.

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OIL CONTRAST

A NEW METHOD OF EXAMINATION OF THE GASTRIC MUCOSA

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THE roentgen examination of the stomach is not complete without a roentgenographic or roentgenoscopic study of the mucosa. This is usually done by graduated compression of the walls. There are, however, portions of the stomach which are inaccessible to compression and there are stomachs which are completely protected by the costal arch. Because of this, attempts were made to obtain a double contrast visualization of the gastric mucosa by the insufflation of air, by means of effervescent powders or by the introduction of air-filled balloons. Although these methods may occasionally give good results they cannot be used as routine because of the discomfort they cause, and because the amount of gas is not easily controllable.

A good double contrast, however, can be obtained in the great majority of patients if, following the ingestion of one-half glass of barium, one administers one-half glass of mineral oil. It will be found then that while enough barium adheres to the mucosa and outlines its relief the excess collects in the most dependent portion of the stomach. The mineral oil, floating over the excess barium, separates the walls of the stomach and allows a very satisfactory

Fig. 1

Fig. 2

double contrast visualization. The oil contrast method can be used following any technique of examination. After the ingestion of oil, the patients should be examined in the upright position (Fig. 1) and in the supine-Trendelenburg position (Fig. 2). The upright position will show the mucosa of the upper half of the stomach, while the supine position will show the mucosa of the body of the stomach and of the antrum.

The oil contrast method will be unsatisfactory in those stomachs which contain an excessive amount of food or mucus. The administration of mineral oil also helps to prevent barium impactions.

Carle Hospital Clinic
Urbana, Ill.

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Advisory Board for Pathology: Eugene L. Opie.

Fiftieth Annual Meeting: Netherland Plaza Hotel, Cincinnati, Ohio, October 4–7, 1949.

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Thirty-second Annual Meeting: 1950, to be announced.

EDITORIALS

CONGENITAL CYSTIC DISEASE OF THE LUNG

THE stimulus to interest in this subject in this country is generally credited to Koontz.[1] This is in some ways remarkable for his paper appeared in a journal not of large circulation and contained a single case report of an infant who died with a variety of disorders, among which were cavities and inflammatory infiltration in the lungs. The paper did contain, however, an extensive review of the literature and a summary of the findings in 108 cases of cystic disease and other pulmonary malformations mostly from the German literature. According to Koontz, no cases of congenital cystic disease of the lung had yet appeared in the American literature. From this study of reported cases he raised the question whether pulmonary cavities result from pulmonary infection or whether pre-existing cavities of developmental origin predispose to a secondary pulmonary infection, and he concluded that the decision is to be made by a careful microscopic examination of the wall of the cavity and adjacent bronchi for evidence of a congenital anatomical malformation. This had not always been evident in the reported cases. Congenital cystic disease of the lung may be regarded fundamentally as a bronchial malformation with an obstruction between the cysts which have a bronchial type of epithelial lining, and the bronchial tree proper.

Subsequent reports indicated that the disease was not at all rare; in fact, the diagnosis of congenital cystic disease was applied without rigid criteria to a variety of pulmonary lesions which we would not now accept. Some of these were certainly emphysematous bullae in the aged, and in children there were cases of transient localized obstructive emphysema occurring in the course of pneumonia described by Benjamin and Childe[2] and by Caffey.[3] Probably many cases of chronic lung abscess and chronic bronchiectasis have also been mislabelled congenital cystic disease or congenital bronchiectasis. In time, considerable skepticism developed concerning the existence of this condition and several roentgenologists of wide experience and even pediatric roentgenologists asserted that they had not to their knowledge encountered such a disease. There has unfortunately been confusion concerning the use of the terms "cyst" and "cystic" in acquired lesions. Perhaps one should not object to this usage for the terms are properly applied to acquired lesions in other organs and such an acquired lesion as an echinococcus cyst is universally accepted as properly labelled. In general, however, the use of the term "cystic disease" for acquired lesions in the lung is misleading, ambiguous and to be avoided. It seems fair to state that the diagnosis of congenital cystic disease of the lung becomes more uncertain and improbable the older the patient. At best the diagnosis was then largely of academic and pathological interest for, as Miller[4] stated in 1926, "a radical cure is out of the question."

This situation was entirely changed by the development of thoracic surgery and

[1] Koontz, A. R. Congenital cysts of the lung. *Bull. Johns Hopkins Hosp.*, 1925, *37*, 340–361.

[2] Benjamin, B., and Childe, A. E. Localized bullous emphysema associated with pneumonia in children. *J. Pediat.*, 1939, *15*, 621–639.

[3] Caffey, J. Regional obstructive pulmonary emphysema in infants and in children. *Am. J. Dis. Child.*, 1940, *60*, 586–605.

[4] Miller, R. T., Jr. Congenital cystic lung. *Arch. Surg.*, 1926, *12*, 392–405.

the demonstration that cysts or portions of lung containing cysts could be removed. Such a successful operation was reported in an infant in 1943 by Fischer, Tropea and Bailey.[5] There have been sufficient subsequent reports to show conclusively that the disease does exist, that it is not extremely rare and that surgery is feasible even in the youngest infants.

Probably the largest series of cases personally observed and treated surgically is contained in the paper of Ravitch and Hardy.[6] They report 12 cases from the Johns Hopkins Hospital, 8 of which were seen in the year before the paper was written. They emphasize the ease and frequency with which cysts become infected and that in such a situation an erroneous diagnosis of chronic empyema or chronic lung abscess is often made. In cases of uninfected expansile air cysts the mistaken diagnosis of pneumothorax and diaphragmatic hernia must be avoided. While they concede that "The diagnosis is based largely on the roentgenographic appearance of the lesions and has usually been fairly obvious," they state that "The ultimate criterion for the diagnosis of congenital cystic disease of the lung in most cases is the gross and microscopic pathologic picture."

The lesson to be drawn from recent studies is that expansile air-containing segments of lung which threaten the function of the remaining lung and chronically suppurating and/or recurrently hemorrhagic lesions in the lung should be treated by surgical removal of the lesion and that the lesion when examined pathologically, especially in infants and children, will often be found to have as a basis an anatomical malformation which may be classified as congenital cystic disease with a malformation of the bronchi.

William A. Evans, Jr., M.D.

[5] Fischer, C. C., Tropea, F., Jr., and Bailey, C. P. Congenital pulmonary cysts. *J. Pediat.*, 1943, *23*, 219–223.

[6] Ravitch, M. M., and Hardy, Janet B. Congenital cystic disease of the lung in infants and in children. *Arch. Surg.*, July, 1949, *59*, 1–36.

SIDNEY CONROY BARROW
1876-1948

DR. SIDNEY CONROY BARROW died of coronary occlusion on August 11, 1948.

He was born in West Feliciana Parish, Louisiana, November 22, 1876. He attended Centenary College and graduated in 1896. He received his Doctor of Medicine from the University of Tennessee in 1901. He moved to Shreveport, Louisiana, in 1906 and began the practice of radiology which he continued until his death.

Dr. Barrow was a pioneer radiologist in Louisiana, and for a good many years was the only radiologist in Shreveport. He served as radiologist to Shreveport Charity Hospital, Tri-State Hospital, North Louisiana Sanitarium and Schumpert Sanitarium. In 1920 he became associated with Dr. W. R. Harwell and this association continued until his death. In his later years he relinquished his active hospital appointments and confined his practice to consultation and the private practice of radiology.

Dr. Barrow was very active in medical society circles. He became president of the Shreveport Medical Society and served as president of the Louisiana State Medical Society in 1932. He became a member of the American Roentgen Ray Society in 1919. He was elected a Fellow of the American College of Radiology in 1926. He was a member of the Radiological Society of North America, the American Medical Association, Louisiana State Medical Society, Shreveport Medical Society and the Shreveport Radiological Club.

Sidney Conroy Barrow

Until recently Dr. Barrow led an active life and made many friends throughout Louisiana and the Southwest. He will be missed by many associates in the medical profession and a host of friends and acquaintances.

JOHNSON R. ANDERSON, M.D.

MONICA DONOVAN

1892-1948

DR. MONICA DONOVAN, a member of the American Roentgen Ray Society since 1922, died on December 29, 1948. She was born February 2, 1892, the daughter of Michael J. and Elizabeth M. Donovan, and lived all her life in San Francisco. She received her A. B. from Stanford University in 1914 and her M.D. in 1917. After serving an internship in the Stanford-Lane Hospital she remained in the Department of Roentgenology and for a number of years was instructor in the Medical School. For many years she was head of the department in St. Mary's Hospital, and she maintained offices at 450 Sutter Street for twenty years.

Dr. Frances Moffett, a former resident on her service, stated in the March issue of the *Bulletin of the San Francisco County Medical Society*, "Dr. Donovan was noted for the professional encouragement and financial help she gave many of her younger colleagues. She was also greatly interested in the San Francisco College for Women, to which she devoted much time. She was loved by many and will be missed by all who knew her."

Ramsay Spillman, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. H. Dabney Kerr, University Hospital, Iowa City, Iowa. Annual meeting: Netherland Plaza Hotel, Cincinnati, Ohio, Oct. 4–7, 1949.

American Radium Society
Secretary, Dr. H. F. Hare, 605 Commonwealth Ave., Boston, Mass. Annual meeting: 1950, to be announced.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N. Y. Annual meeting: Cleveland Auditorium and Statler Hotel, Cleveland, Ohio, Dec. 4–9, 1949.

American College of Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6. Annual meeting: 1950, to be announced.

Section on Radiology, American Medical Association
Secretary, Dr. Paul C. Hodges, 950 E. 59th St., Chicago, Ill. Annual Meeting: 1950, to be announced.

Alabama Radiological Society
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

Arizona Association of Pathologists and Radiologists
Secretary, Dr. R. Lee Foster, 507 Professional Bldg., Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Atlanta Radiological Society
Secretary, D. W. W. Bryan, 490 Peachtree St., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

Central Ohio Radiological Society
Secretary, Dr. Paul D. Meyer, Grant Hospital, Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Seneca Hotel, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. John H. Gilmore, 720 N. Michigan Ave., Chicago 11, Ill. Meets second Thursday of each month October to April inclusive at the Palmer House.

Cincinnati Radiological Society
Secretary, Dr. Eugene L. Saenger, 735 Doctors Bldg., Cincinnati 2, Ohio. Meets last Monday of each month, September to May, inclusive.

Cleveland Radiological Society
Secretary, Dr. J. R. Hannan, Cleveland Clinic, Cleveland 6, Ohio. Meetings at 6:30 P.M. on fourth Monday of each month from October to April.

Colorado Radiological Society
Secretary, Dr. Mark S. Donovan, 306 Majestic Bldg., Denver 2, Colo. Meets third Friday of each month at Department of Radiology, Colorado School of Medicine.

Connecticut Valley Radiologic Society
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. W. G. Belanger, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

East Bay Roentgen Society
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

Florida Radiological Society
Secretary, Dr. F. K. Hurt, Riverside Hospital, Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

Georgia Radiological Society
Secretary, Dr. Robert Drane, DeRenne Apartments, Savannah, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

Houston X-ray Club
Secretary, Dr. Curtis H. Burge, 3020 San Jacinto St. Houston 4, Texas. Meets fourth Monday each month.

Radiological Society of Kansas City
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

Illinois Radiological Society
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

Iowa X-Ray Club
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. Special meetings by announcement.

Kansas Radiological Society
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

Kentucky Radiological Society
Secretary, Dr. W. C. Martin, 321 W. Broadway, Louisville. Meets annually in Louisville on first Saturday in Apr.

Kings County Radiological Society
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

Los Angeles Radiological Society
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

Louisville Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Louisville General Hospital.

* Secretaries of societies are requested to send timely information promptly to the Editor.

Michigan Association of Roentgenologists
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

Milwaukee Roentgen Ray Society
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. Chauncey N. Borman, 802 Medical Arts Bldg., Minneapolis 2, Minn. Two meetings yearly, one at time of Minnesota State Medical Association the other in the fall.

Nebraska Radiological Society
Secretary, Dr. Ralph C. Moore, Nebraska Methodist Hospital, Omaha 3, Nebr. Meets third Wednesday of each month, at 6 P.M. at either Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. George Levene, Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday, Boston Medical Library.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. F. H. Ghiselin, 111 East 76th St., New York 21, N. Y. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings held by announcement.

Northern California Radiological Club
Secretary, Dr. C. E. Grayson, Medico-Dental Bldg., Sacramento 14, Calif. Meets at dinner last Monday, every second month, except June, July and August.

Ohio State Radiological Society
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. W. E. Brown, Tulsa, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. Boyd Isenhart, 214 Medical Dental Bldg., Portland 5, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M., Library of University of Oregon Medical School.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport. Annual Meeting: May 20 and 21, 1949, Bedford Springs Hotel, Bedford, Pa.

Philadelphia Roentgen Ray Society
Secretary, Dr. G. P. Keefer, 1930 Chestnut St. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary, Dr. R. P. Meader, 4002 Jenkins Arcade Pittsburgh 22, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Queens Roentgen Ray Society
Secretary, Dr. J. E. Goldstein, 88-29 163rd St., Jamaica 3, N. Y. Meets fourth Monday of each month except during the summer.

Radiological Section, Baltimore Medical Society
Secretary, Dr. Harry A. Miller, 2452 Eutaw Place, Baltimore. Meets third Tuesday each month, September to May.

Radiological Section, Connecticut Medical Society
Secretary, Dr. Fred Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

Radiological Section, District of Columbia Medical Society
Secretary, Dr. K. C. Corley, 1835 Eye St., N. W., Washington, D. C. Meets Medical Society Auditorium, third Thursday, January, March, May, October at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr. Roy G. Giles, Temple, Texas.

Radiological Society of New Jersey
Secretary, Dr. Raphael Pomeranz, 31 Lincoln Park, Newark, N. J. Meets annually at time and place of State Medical Society. Mid-year meetings at place chosen by president.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. Ralph E. Alexander, 101 Medical Arts Bldg. Meets monthly on third Monday from October to May, inclusive, 8 P.M. at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr. Meets Shirley-Savoy Hotel, Denver, Colo. August 18, 19, 20, 1949.

St. Louis Society of Radiologists
Secretary, Dr. C. J. Nolan, 737 University Club Bldg., St. Louis 3, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

San Diego Roentgen Society
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Wednesday at dinner.

Section on Radiology, California Medical Association
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Carolina X-Ray Society
Secretary, Dr. T. A. Pitts, Baptist Hospital, Columbia, S. C. Meets in Charleston on first Thursday in November, also at the time and place of South Carolina State Medical Association.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Next meeting, Dallas, Texas, February 3 and 4, 1950.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. Homer V. Hartzell, 310 Stimson Bldg., Seattle 1, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

X-Ray Study Club of San Francisco
Secretary, Dr. W. F. Reynolds, University of California Hospital, San Francisco. Meets from January to July, 1949, at Lane Hall, Stanford University Hospital, and from July to December 1949, at San Francisco Hospital.

Cuba

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Mexico

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 p.m.
Medical Members' meeting, on third Friday in each month at 5:00 p.m., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 p.m. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary, Dr. E. M. Crawford, 1535 Sherbrooke St., West, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
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Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Sociedad Argentina de Radiologia
Secretary, Dr. Guido Gotta, Buenos Aires, Argentina. Meetings are held monthly.

Sociedad Argentina de Radiología, Filial del Litoral
President, Dr. Francisco P. Cifarelli. Meets second Wednesday each month, at 7:00 p.m., at 663 Italia St. in Rosario.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Andrelino Amaral, Av. Brigadeiro Luiz Antonio, 644, São Paulo, Brazil. Meets monthly on second Tuesday at 9 p.m. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Alliés, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Ceskoslovenská společnost pro röntgenologii a radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Next meeting, Krakow, June 2 and 3, 1949.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10.30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Măräcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad.
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin. Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky. Meets monthly, first Monday, 8 p.m.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
President, Dr. H. E. Walther, Gloriastr. 14, Zürich, Switzerland.

Societa Italiana di Radiologia Medica
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

MASS GASTRIC ROENTGENOLOGICAL SURVEYS FOR CONTROL OF GASTRIC CANCER

To the Editor:

Dr. Sherwood Moore,[1] in his paper in this JOURNAL for April, 1949, points out the great potential value of mass gastric roentgenological surveys for control of gastric cancer when he states, "It could, if found feasible, save many lives." A diagnostic procedure that could save many lives should not be discouraged, especially in the experimental stage, for other than weighty reasons. It is important, therefore, to examine closely the reasons which Dr. Moore advances in opposition to this method.

Dr. Moore presents the following arguments against mass gastric surveys:

1. "The high incidence of gastric cancer is exaggerated." (p. 470)
2. It "would require far more radiologists than are available for that purpose." (p. 471)
3. "There would be enormous risk to the roentgenoscopist." (p. 471)
4. It "is a very uncertain way of detecting any early lesion." " . . . it is the early lesion that is most likely to be overlooked by any part of the roentgen examination." (p. 471)
5. According to Kirklin and Hodgson, "It would be necessary to examine individuals every three months, which, for the whole adult population, is an absurdity." (p. 471)

With respect to point one, Dr. Moore presents data on 1,352 carcinomas of the gastrointestinal tract diagnosed by roentgen examination, presumably at the Edward Mallinckrodt Institute of Radiology,* from 1916 to 1947, inclusive. Of these, 45.8 per cent were gastric, 27.2 per cent were of the large intestine, 18.8 per cent were of the esophagus, 8.2 per cent were of the rectum, and 0.2 per cent were of the small intestine. Dr. Moore interprets these figures to mean that "if all gastric cancers were diagnosed early by mass methods, there would remain a large number of cancers elsewhere in the tract that would escape detection." This amounts to a plea against mass detection of one type of cancer because the method used would not detect other types. By the same reasoning, one would reject attempts to detect carcinoma of the uterus by the vaginal smear technique, because cancer of the breast is not also detected by this method, or cancer of the skin, or of the ovaries, etc. Certainly, the ideal detection examination would be one with a high percentage of efficiency of detecting early, asymptomatic cancer wherever it may occur in the body. This ideal probably will be achieved only when appropriate individual detection techniques for each organ are developed. These techniques must be developed separately for each organ, since each presents special diagnostic problems. Even the discovery of a test, such as a serological examination, that would indicate the presence or absence of cancer *anywhere* in the body would leave the problem of determining in which organ the cancer was located. Hence, the further development of detection tests for organs like the stomach, in which cancer occurs frequently and for which a promising examination method is available, is of importance, from any standpoint.

The incidence and mortality of gastric carcinoma unfortunately require no exaggeration. Gastric carcinoma was certified as the cause of death of 25,625 persons in the United States in 1946.[2] It is the most frequent form of cancer causing death among males, accounting for 18.0 per cent of all male cancer deaths, and the fourth most frequent form among females, accounting for 10.3 per cent of female cancer deaths. The annual incidence of new cases among the population aged forty and over in New York State in 1945–1947 was 46 per 100,000.[3] With present methods of diagnosis and treatment, the average five

[1] Moore, S. Mass roentgenological survey of the gastrointestinal tract to detect cancer of the stomach. AM. J. ROENTGENOL. & RAD. THERAPY, April, 1949, *61*, 470–474.

* "About half of these cases were from the Edward Mallinckrodt Institute of Radiology and the other half were from its predecessor, the X-Ray Department of the Washington University Medical School. Methods and equipment were the same in both places."—Sherwood Moore.

[2] Selected Facts and Figures on Cancer, The American Cancer Society, February, 1949.

[3] Bureau of Cancer Control, New York State Department of Health.

year cure rate is reliably estimated at less than 5 per cent, whereas the five year cure rate for all resected lesions is approximately 25 per cent. If mass detection were successful in detecting only one-half of lesions in the resectable stage, the saving of lives would be approximately $\frac{1}{2} \times 25$ per cent $\times 25{,}625$, or 3,203 lives. It would appear that the incidence and mortality of gastric carcinoma are sufficiently great to justify efforts to improve early diagnosis and to increase the present low cure rate by any feasible means, including mass gastric surveys.

With respect to points two, three, and four above, these objections to mass gastric surveys are all based on the assumption that the sole method which can be used is that of examination by roentgenoscope, followed by roentgenograms. This time-consuming method would indeed limit the number of examinations performed and would virtually exclude the possibility of examining any large proportion of the adult population at frequent intervals. Even with this limitation, there would still remain the possibility of employing this method of detection in selected groups of the population known to have an increased risk of developing gastric carcinoma. Examples of such groups would be: males aged sixty-five and over, in which the annual incidence of stomach cancer is 123 per 100,000; pernicious anemia patients, in which Rigler and Kaplan[4] found an incidence of 6.9 per cent carcinoma and 6.6 per cent of gastric polyps[5], and the "precursor group" studied at the University of Minnesota Hospitals since July 1, 1945,[6] consisting of persons having achlorhydria or hypochlorhydria, pernicious anemia, a family history of gastric carcinoma, a hemoglobin level of 11.0 grams or less, or occult blood in the stools. In this group, Ruzicka reports the following results:

Age	Number of Persons	Number of Gastric Carcinoma	Polyps	Gastric Carcinoma and Polyps: Rate per 1000
Under 65	764	0	17	22.2
65 and over	827	8	19	32.6

These results were attained as a result of 1,967 examinations made on 1,591 persons. They confirm both the feasibility and desirability of mass gastric surveys, even with standard methods, in selected population groups.

Moreover, Dr. Moore, in his discussion of mass gastric surveys, for some reason does not mention the photofluorographic method, which eliminates the element of overexposure for the roentgenologist and greatly increases the number of examinations which can be made rapidly by a relatively small number of roentgenologists and technicians.[7]

The Johns Hopkins groups have shown (unpublished data on 4,000 examinations) that photofluorographic examinations of persons coming to their outpatient clinics detect approximately 97 per cent of all gastric pathology and all cases of gastric cancer, which would have been discovered by the standard roentgenological procedures. This examination is done without roentgenoscopy, by trained roentgen-ray technicians, without completely disrobing the patient, with a series of six films taken over a five minute period, with the aid of the usual opaque medium. By this procedure the technician does the roentgenography and the roentgenologists do the interpretation on screening films and follow-up with complete examinations on persons with suspicious findings. There are enough radiologists in the country to carry out such a plan on the adult population over a reasonable period of time. The results would

[4] Rigler, L. G., and Kaplan, H. S. Pernicious anemia and tumors of stomach. *J. Nat. Cancer Inst.*, 1947, *7*, 327–332.

[5] Parenthetically, we wonder at the lack of reference to gastric polyps in Dr. Moore's discussion of mass gastric surveys, since (*a*) the precancerous nature of gastric polyps is generally recognized and (*b*) their prevalence is considerably greater than that of gastric carcinoma, so that the value of mass surveys in detecting significant pathology of the stomach is correspondingly increased.

[6] Bulletin of the University of Minnesota Hospitals and Minnesota Medical Foundation XX, No. 31, June 10, 1949, pp. 660–667. (The table presented above is rearranged from data presented in this paper.)

[7] Roach, J. F., Sloan, R. D., and Morgan, R. H. Detection of gastric carcinoma by photofluorographic methods. Parts I and II. Am. J. Roentgenol. & Rad. Therapy, Feb., 1949, *61*, 183–187; 188–194.

be more early operable gastric cancers and fewer late inoperable cases; more living cancer patients and fewer dead ones (even though their premortal diagnosis was correct and complete); more time well spent on interesting cases for the busy radiologist and less wasted time on normal persons.

The results already obtained by the Johns Hopkins group, as reported at the June, 1949, meeting of the American Medical Association, Section on Radiology, are pertinent to the objections raised by Dr. Moore, that roentgenologic gastric surveys would not detect early lesions and that they would have to be performed on the same individuals at too short intervals, such as three months, to be practicable (points 4 and 5 above). Out of 27 cases of gastric carcinoma detected by the photofluorographic method and confirmed by the standard roentgenographic procedures, 8 cases had either no symptoms or such mild symptoms that it has not been possible to persuade these patients to undergo operation. They are being followed and re-examined at frequent intervals, so that valuable objective data on the course of early asymptomatic gastric carcinoma are being collected. These observations, of course, will have to be extended, but they suggest that the course of gastric carcinoma in its early asymptomatic stage is sufficiently slow so that periodic examinations at intervals greater than a year may be sufficient to detect most lesions at this stage.

The experience already at hand thus indicates that none of the objections raised by Dr. Moore against mass gastric surveys is valid, either for the standard roentgen diagnostic procedure when applied to selected population groups, or for the photofluorographic method, to be applied to larger groups.

Dr. Moore also gives the opinion that mass chest roentgenologic surveys have "glaring defects" because more cases are found than there are facilities with which to provide care. Surely this is not a defect of the diagnostic method. The most effective way to stimulate the community to provide adequate facilities is to show the need, by finding the cases. In some communities, such as Minneapolis, Seattle, and Niagara Falls, mass chest surveys have reached over 75 per cent of the adult population. Even if full facilities for sanatorium care of all newly discovered cases are not available, the individuals concerned have been warned of the presence of tuberculosis and they, their physicians and the local health department have been enabled to take steps to prevent extension of the disease or its spread to other persons. Dr. Moore goes on to cite, as an example of a successful tuberculosis control program without mass chest roentgenologic surveys, the eradication of tuberculosis in cattle. One need only remember that this was done simply by mass tuberculin testing of cattle and mass slaughtering of those found positive, to judge whether this program could be considered as a substitute for mass chest roentgenograms, in the control of tuberculosis in human beings.

On the basis of the importance of gastric cancer as a cause of disability and death, and the already demonstrated feasibility and practicability of mass gastric surveys, especially with the photofluorographic technique, in the early detection of gastric cancer, we feel that none of the objections thus far raised against this method is sufficiently valid to justify interruption of efforts to improve, expand and, eventually, apply to the entire adult population, this case-finding procedure for early gastric cancer.

State of New York
Department of Health
Albany, N. Y.

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Morton L. Levin, M.D.
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Director, Bureau of Cancer Control

THE JOURNAL OF THE FACULTY OF RADIOLOGISTS

There has just arrived at the editorial desk, Volume 1, Number 1, of *The Journal of the Faculty of Radiologists*. This latest journal dealing with radiological problems is the official organ of the Faculty of Radiologists of London, England, and is published quarterly in July, October, January and April by John Wright and Sons, Ltd. The subscription price to non-members is £2.2s. a year.

The Faculty of Radiologists feels that the time is opportune for the publication of a journal devoted to clinical radiology, and sensing the need of such a publication they have just issued their first number. The Faculty of Radiologists is recognized by the Government as the body representing medical radiology and as a result of this recognition the Faculty of Radiologists feels that it is imperative that it should have some official organ to make public its activities.

If the content of their first volume is a forecast of what is to follow, the journal should meet with a ready acceptance throughout the radiological world. Their first issue deals with "Cerebral Tumours"; an interesting paper on "A Comparison of the Radiological and Pathological Changes in Coalworkers' Pneumoconiosis"; "The Classification of Radiographic Appearances in Coalminers' Pneumoconiosis"; "The Place of Radiotherapy in the Treatment of Chronic Lymphoid Leukaemia"; "Radiotherapeutic Treatment of Leukaemia"; "The Doctor-Patient Relationship in the Treatment of Cancer."

The radiological world welcomes with pleasure this latest publication by the Faculty of Radiologists. The distinguished members of that organization have world-wide reputations and a journal issued under their aegis should be among the finest.

WISCONSIN RADIOLOGICAL SOCIETY

A new society of radiologists of the state of Wisconsin was organized at a meeting held in Madison, Wisconsin, on August 26, 1949. The organization is called the Wisconsin Radiological Society and has thirty-five charter members, all of whom are diplomates of the American Board of Radiology. The following officers were elected: *President*, Dr. Lawrence V. Littig, Madison; *President Elect*, Dr. Ernst A. Pohle, Madison; *Secretary Treasurer*, Dr. Irving I. Cowan, Milwaukee; *Board of Censors*, Dr. S. Richard Beatty, Neenah, Dr. J. Edwin Habbe, Milwaukee, and Dr. Victor J. Bruder, La Crosse.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

NEOPLASMS OF BONE AND RELATED CONDITIONS: THEIR ETIOLOGY, PATHOGENESIS, DIAGNOSIS, AND TREATMENT. By Bradley L. Coley, M.D., Attending Surgeon, Bone Tumor Department, Memorial Hospital for Cancer and Allied Diseases; Assistant Professor of Clinical Surgery, Cornell. Cloth. Price, $17.50. Pp. 765, with 622 illustrations and 53 tables. New York: Paul B. Hoeber, Inc., 1949.

In this book the author has compiled a very comprehensive study of neoplasms of bone based on his large experience which includes at least twenty-five years spent in the Bone Tumor Department of Memorial Hospital. This is demonstrated by the titles of the eleven sections into which the book is divided.

Section One includes the classification of tumors, etiology, diagnostic survey in suspected cases of bone tumor, differential diagnosis, and the last chapter is a discussion of the role played by blood chemistry in bone tumors by Helen Q. Woodard, M.D. This is well worth special mention. Section Two includes benign tumors and tumorlike lesions of bone. Then follow, primary malignant tumors of bone, tumors involving bone by extension, metastatic tumors involving bone, tumors of bone in special localities, surgical treatment, radiation therapy, constitutional therapy, lesions of the skeletal system that may simulate neoplasms of bone and a final section entitled Miscellaneous which includes pathologic fractures, medicolegal aspects of trauma in tumors of bone, and the experimental production of bone sarcoma.

The illustrations, especially the roentgenograms of the various lesions, are clearly reproduced and are in sufficient number to show the wide variations in the appearance of some types of lesions. Not only the common types but also the unusual and the more rare types of tumors are shown.

In the preface Coley states the purpose of the book is to present the subject in a form that will be of value not only to the oncologist but also to the orthopedist, the radiologist, the general surgeon and the general practitioner, and in this effort he has been successful. Objection may be raised that comparatively little emphasis is placed on the microscopic pathology of the various tumors but this is atoned for by greater emphasis on the clinical aspects, the difficulties of early diagnosis, the differential diagnosis, various therapeutic indications and technics, and the results of treatment.

Coley believes it is no exaggeration to say that nearly half of the cases of osteogenic sarcoma have the disease in detectable form for more than six months before a correct diagnosis is made. One can only speculate on the favorable effect on survival rates were this period of time cut in half. This, Coley believes, could be accomplished by a keener realization of the significance of the early symptoms and a wider tendency to insist upon early roentgenographic examination when these symptoms are present.

The section on radiation therapy is a fair and just estimate of its value and includes discussion of the physical factors involved in the irradiation of tumors of bone, the effect of radiation on bone, indications for roentgen therapy, methods and dosage, effect of radiation on neoplasms of bone and the effect of radium poisoning on skeletal tissue.

The bibliography is ample and the index includes one of personal names in addition to the one of subjects. The format of the book is excellent. It should be in the library of every radiologist. Not only is it valuable for the wide coverage of the subject, but also for the inclusion of the newer types of lesions described in the literature of the past decade, now generally accepted as entities.

R. S. BROMER, M. D.

MANAGEMENT OF COMMON GASTRO-INTESTINAL DISEASES. Edited by Thomas A. Johnson. The American Practitioner Series. Cloth. Price, $7.00. Pp. 280, with 16 illustrations. Philadelphia: J. B. Lippincott Co., 1948.

This book of 280 pages, written by twenty-one contributors, contains condensed and

authoritative statements relating to the commonly encountered gastrointestinal diseases. The authors and their topics are well selected, and the subjects covered adequately. Naturally in such a large field, there is ample opportunity for divergent points of view, but in general it can be said that the opinions expressed are sound and mature.

In a number of the chapters the all important influence of emotional tension on gastrointestinal symptomatology is properly stressed. The discussion of Edward Weiss on "Psychosomatic Aspects of Gastro-Intestinal Disorders" should be read and assimilated by all physicians who practice medicine, regardless of whether their interest is limited to the field of gastroenterology. His ability to discuss the subject clearly and emphasize important points by apt phraseology is illustrated by the following: "The abdomen is, indeed, the sounding board of the emotions," "the chronic gastro-intestinal invalid with a battle-scarred abdomen of polysurgical addition"; and "the unconscious will remain sick." With reference to unnecessary abdominal operations he says: "A willing and eager patient who derives a certain satisfaction from being hospitalized and operated upon and a surgeon who is ever ready to wield a knife, is a very unfortunate combination."

The chapter on "The Diagnosis and Treatment of Irritable Colon" by E. N. Collins is one of importance as it deals with a common disorder with which every physician should be thoroughly familiar. The author emphasizes that the irritable colon (unstable colon, functional colon, mucous colitis, or spastic bowel) is a frequent cause of abdominal complaints and one of the most neglected entities in the practice of medicine. Of special importance is emphasis on the tendency to perform unnecessary operations on such patients, and he cites as evidence a table which indicates that almost one-third of such patients were operated upon without relief of symptoms. It is of interest to note that of 204 patients with irritable bowel, the appendix had been removed in 163.

The chapter on "The Diagnosis of Pancreatic Disease" by Thomas A. Johnson deserves special commendation. The subject is covered adequately and is doubtless based on a wide experience in this field. He emphasizes, in speaking of carcinoma of the pancreas, that diagnostic accuracy is not great, especially when jaundice is absent. The major role of this condition as a basis for obscure abdominal pain should be kept in mind. Among other diagnostic measures which he advocates is the roentgenological study of the pancreas through changes produced in the adjacent segments of the gastrointestinal tract which yields valuable information and should be employed more extensively.

The diagnosis and management of distal ulcerative colitis is discussed by Johnson in 14 pages. When the controversial nature of many of the aspects of this disease is considered, it must be agreed that he has condensed them all satisfactorily into a relatively small space. He considers all of the forms of treatment which have been advocated in a sensible fashion. Some will dissent, however, from his opinion that "When it becomes apparent that the patient is not coping with the disease, and before he becomes a poor surgical risk, ileostomy becomes a procedure of choice." The operative procedure suggested is probably correct but the difficulty arises in deciding *when* such an operation is propitious.

The book is to be recommended as a well written, reliable collection of articles dealing with the common gastrointestinal diseases, which covers the field briefly but adequately.

Cyrus C. Sturgis, M.D.

Handbook of Diseases of the Skin. By Richard L. Sutton, M.D., Emeritus Professor of Dermatology and Syphilology, University of Kansas Medical School, and Richard L. Sutton, Jr., M.D., Associate Professor of Dermatology and Syphilology, University of Kansas Medical School. Cloth. Price, $12.50. Pp. 749, with 1057 illustrations. St. Louis: C. V. Mosby Co., 1949.

The Suttons are well known authors of several textbooks of dermatology, including a Synopsis and an Introduction to Dermatology which is in its fourth edition. The present volume is more complete than the former and less voluminous than the latter and is aimed at supplying a textbook for the needs of the student and general practitioner. It follows in general the usual development of the subject with many excellent illustrations and should serve its purpose well as a standard textbook of dematology.

As far as the radiologist is concerned, one is struck as with all textbooks of dermatology at the dearth of information on roentgen rays and other forms of radiant therapy despite

the frequency with which these therapies are recommended and utilized by dermatologists. A second criticism which may be minor but which was disconcerting to the present reviewer is the frequent occurrence of statements such as the following paragraph on the use of sex hormones:

"Sex hormones, including male, female, and gonadotropic, have utility in some conditions. They are potent substances . . . and can cause trouble. Estrogenic substances in correct dosage may help rosacea and some cases of acne." However, this form of empiric therapy is generally recognized as a defect of dermatology and the present text cannot be held accountable for a failing general to the subject.

Arthur Grollman, M.D.

An Introduction to Gastro-Enterology. By Walter C. Alvarez, Professor of Medicine, University of Minnesota, The Mayo Foundation, and a Senior Consultant in the Division of Medicine, The Mayo Clinic. Fourth edition, revised and enlarged. Cloth. Price, $12.50. Pp. 903, with 269 illustrations. New York: Paul B. Hoeber, Inc., 1948.

An interesting fact which has gradually been lost sight of in the prefaces to the subsequent editions is that the first edition of this work consisted of the elaborated first annual Caldwell Lecture, established by the American Roentgen Ray Society in 1920 in honor of Eugene Wilson Caldwell, one of the most beloved and respected of the early American radiologists.

The work has grown from a relatively small volume in the first edition to the present fourth edition of nine hundred pages. The older members of our specialty may remember a similar book by H. Roger, famous French savant, which in the early years of this century served as a textbook for students beginning the study of internal medicine. It was a delightful and most readable work. For the student of today, we have its counterpart for the digestive tract in this excellent work by Alvarez.

The author's writings have a characteristic appeal for the reader which keeps up his interest in each paragraph. The discussion concerns principally the motor function of the digestive tube and discusses just about every possible phase of its motor functions.

The new additions to the text include chapters on the pylorus, the nerves running to the bowel, the nerves of the gallbladder, the functions of the colon, flatulence, the electroenterogram, technical methods and apparatus, and finally, because of the present-day interest in the Dragstedt operation, much information has been included on the effects of vagotomy in man.

James T. Case, M.D.

Bilharzial Cancer: Radiological Diagnosis and Treatment. By Mahmoud Ahmed Afifi, M.B., Ch.B. (Cairo), M.R.C.S. (England), L.R.C.P. (London), D.M.R.E. (Cambridge). Former Director of the Radiological and Electro-therapeutic Departments of the Egyptian Government Hospital, Alexandria. Cloth. Price, 16/. Pp. 111, with 60 illustrations. London: H. K. Lewis & Co., Ltd., 1948.

This condition is found mostly in Egypt and its environs. The mongraph will therefore be limited in its appeal. The reviewer found the text absorbing because of the unusual ramifications of the disease.

A peculiar "water wash" appearance was observed in roentgenograms of the abdomen attributable to the calcium contained in the bilharzial ova. The bladder, prostate, and rectum seemed unusually susceptible to superimposed carcinoma of the scirrhous type.

Treatment was no more effective in these cancers than it is in other similar forms of malignant disease.

The book is easy to read and the paper, illustrations and type are good.

Philip J. Hodes, M.D.

Histopathology of Irradiation from External and Internal Sources. (National Nuclear Energy Series IV—22 I.) Edited by William Bloom, M.D., Professor of Anatomy, Department of Anatomy and Institute of Radiobiology and Biophysics, University of Chicago. Cloth. Price, $8.00. Pp. 808, with numerous illustrations. New York: McGraw-Hill Book Co., Inc., 1948.

Histopathology of Irradiation from External and Internal Sources is an 808 page volume, including appendix, bibliography, and index. It is volume 22 I of Division IV of the Atomic Energy Publications of sixty volumes which are to cover the declassified work of eight separate projects. The Plutonium Project is Division IV.

The material reported consists of a summary of the work performed from 1943–1945 by the Histological Group of the Health Division, Metallurgical Laboratory, University of Chicago. The histopathological effects of whole body irradiation in animals by internal and external sources are recorded.

Roentgen rays, gamma rays, beta rays, and fast and slow neutrons were applied externally, while alpha-, beta-, and gamma-emitting substances were introduced into animals from a variety of sources. Most of the work was cytological rather than histopathological study. Hematoxylin-eosin-azure II staining technique was utilized. Dosage employed was normally the $LD_{50}/30$ days. Most of the animals utilized were mice and rats, with fewer rabbits and guinea pigs.

Histopathological studies reported refer to body cells, skin, bone, bone marrow, spleen, lymph node and intestinal lymphatic tissue, thymus, gastrointestinal tract and accessory structures, testis, ovary, kidney, lung, vascular system, adrenal, and the nervous system. Changes in most tissues are those previously reported, although only the acute effects of irradiation in tissue were observed.

This publication adds detail in the form of knowledge of effects of a variety of radioactive compounds but does not supplement the sum total of knowledge of the histopathologic changes attributable to irradiation. As a reference work for the experimentalist in the field of radiology the publication is of value, but it is impractical for the pathologist or clinician as it was prepared by workers with an inadequate background in histopathology.

A. James French, M. D.

ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

Department Editor: George M. Wyatt, M.D., 1835 Eye St., N.W., Washington 6, D. C.

INDEX TO ABSTRACTS

ROENTGEN DIAGNOSIS

Head

McGregor, M.: Significance of certain measurements of the skull in the diagnosis of basilar impression 584

Neck and Chest

Haight, C.: Congenital tracheo-esophageal fistulas without esophageal atresia 584
Hueber, F., and Gaja, C.: Stratigraphy in the diagnosis of less common diseases of the larynx 584
Kinsella, T. J., Morse, R. W., and Hertzog, A. J.: Spontaneous rupture of esophagus. 584
Roemmich, W., Weber, F. J., *et al.*: Preliminary report on a community-wide chest x-ray survey at Minneapolis, Minnesota. 585
Castaldi, L.: Serialographic investigation in roentgenological examination of respiratory apparatus 585
Giannardi, G.: Study of roentgenographic anatomy of normal thymus with pneumomediastinum 586
Adams, W. E.: Differential diagnosis and treatment of congenital cystic malformation of the lung 587
Walker, J. M., Taggart, W. B., and Staton, H. J.: Tension type of congenital pulmonary cyst 587
Ortmayer, M.: Cystitis emphysematosa 587
Smith, C. E., Beard, R. R., and Saito, M. T.: Pathogenesis of coccidioidomycosis with special reference to pulmonary cavitation. 588
Mackie, T. T.: Parasitic infection of the lung. 588
Machle, W.: Pathogenesis of industrial pulmonary disease 589
Shaver, C. G.: Further observations of lung changes associated with manufacture of alumina abrasives 589
Wilson, S. A.: Delayed chemical pneumonitis or diffuse granulomatosis of lung due to beryllium 590
Bergmann, M., Shatz, B. A., and Flance, I. J.: Apical pulmonary carcinoma and tuberculosis 590
Gardella, G.: Alterations in thoracic cage in diagnosis of lung tumors 590
Crimm, P. D.: Spontaneous collapse 590
Blades, B.: Empyema 591
Carson, M. J., *et al.*: Diagnosis of pulmonary stenosis by angiocardiography 591

Abdomen

Cave, P.: Stomach in femoral hernia 591
Bralow, S. P., Scheinberg, S., and Necheles, H.: Peptic ulcer and pregnancy 592
Bassler, A., and Peters, A. G.: Distinctions between gastric sarcoma and carcinoma .. 592
Conti, J. G., Jr., Foltz, T. P., and Stevens, G. A.: Surgical and roentgenologic aspects of duodenal diverticula 593
Reid, D. R. K.: Argentaffinoma of the gastrointestinal tract 593
Glass, W. H.: Small intestinal deficiency pattern 593
Delario, A. J.: X-ray examination of the vermiform appendix 594
Gross, R. E., and Ware, P. F.: Intussusception in childhood 594
Ravitch, M. M., and McCune, R. M.: Reduction of intussusception by barium enema. 594
Mantovani, D., and Stranieri, R.: Case of double gallbladder 595
Comfort, M. W., Gray, H. K., and Wilson, J. M.: The silent gallstone 595
Doubilet, H., and Mulholland, J. H.: Recurrent acute pancreatitis 595

Gynecology and Obstetrics

Foote, F. W., Jr., and Stewart, F. W.: Anatomical distribution of intraepithelial epidermoid carcinomas of cervix 596
Solomon, E. P., and Loveman, A. B.: Chancre and carcinoma of cervix 596
Cohen, M., and Cravotta, C. A.: Sarcoma of uterus 596

Genitourinary System

Samuel, E.: Calcification in suprarenal neoplasms 596
Braasch, W. F., Greene, L. F., and Goyanna, R.: Renal ptosis and its treatment. 597
Low, H. T., and Coakley, H. E.: Leukoplakia of renal pelvis 597

Culp, O. S., and Hartman, F. W.: Mesoblastic nephroma in adults 597
Arnheim, F. K.: Carcinoma of the prostate .. 598

Nervous System

Smith, C. A.: Paraganglioma (pleochromocytoma) 598

Skeletal System

Ellis, V. H.: Squamous-cell carcinoma of the nail bed 599
Edmonds, H. W., Coe, H. E., and Tabrah, F. L.: Bone formation in skin and muscle. 599
Brailsford, J. F.: Ossifying hematomata and other simple lesions mistaken for sarcomata 599
Ponseti, I.: Bone lesions in eosinophilic granuloma, Hand-Schüller-Christian disease and Letterer-Siwe disease 600
Wilson, J. C., Jr.: Streptomycin in the treatment of chronic infections of bone 601
Warrick, C. K.: Posterior dislocation of the shoulder joint 601
Khoo, F. Y., and Kuo, C. L.: Unusual anomaly of inferior portion of the scapula 601
Vitt, R. J.: Dislocation of head of the fibula .. 602
Fairbank, T. J.: Knee joint changes after meniscectomy 602
Leveuf, J.: Results of open reduction of "true" congenital luxation of the hip 602
Le Mesurier, A. B.: Developmental coxa vara 603
Viterbo, F.: Roentgenological contribution to the study of vertebral echinococcus cysts. 604
Lischi, G.: Two cases of primary sclerosis of a solitary vertebra 604
Roche, M. B.: Bilateral fracture of the pars interarticularis of a lumbar neural arch ... 605
Caldwell, G. A., and Sheppard, W. B.: Criteria for spine fusion following removal of protruded nucleus pulposus 605
du Toit, J. G., and Fainsinger, M. H.: Spinal extradural cysts 605
Zadek, I., and Gold, A. M.: Accessory tarsal scaphoid 606
Harris, R. I., and Beath, T.: Etiology of peroneal spastic flat foot 606
Fairbank, H. A. T.: Dyschondroplasia 607
Sherman, Mary S.: Estrogens and bone formation in human female 608
Vandemark, W. E., and Page, M. A.: Massive hyperplasia of bone following fractures of osteogenesis imperfecta 608

General

Archer, V. W., Cooper, G., Jr., and Adair, N.: Symptoms masked or modified by chemotherapy 608
Peskin, A. R.: Increased sugar tolerance as a factor in the production of a symptom complex simulating peptic ulcer, neurocirculatory asthenia and psychoneurosis .. 609
Brodsky, E.: Income-sharing formula 609

ROENTGEN AND RADIUM THERAPY

Trusler, H. M., and Bauer, T. B.: Keloids and hypertrophic scars 609
Kimbrough, R. A., and Muckle, C. W.: Treatment of carcinoma of the cervix 610
MacFarland, Catharine, Sturgis, Margaret C., and Fetterman, Faith S.: Control of cancer of the uterus 610
Costolow, W. E.: Management of Stage I carcinoma of cervix uteri 610
Hall, J. W., and Friedman, M.: Histologic changes in squamous-cell carcinoma of the mouth and oropharynx produced by fractionated external roentgen irradiation 611
Hamann, Anna: External irradiation with roentgen rays and radium in treatment of human leukemias, lymphomas, and allied disorders of hemopoietic system 612
Spurr, C. L., Smith, T. R., and Jacobson, L. O.: Chemotherapy in human lymphomas, leukemias, and allied disorders of hemopoietic system 612
Karnofsky, D. A.: Chemotherapy of neoplastic disease. I 613
Karnofsky, D. A.: Chemotherapy of neoplastic disease. II 613
Karnofsky, D. A.: Chemotherapy of neoplastic disease. III 613
Donnelley, G. C., and Bauld, A. G.: Aspects in treatment of vulvar and cervical carcinoma 613
Speert, H., and Peightal, T. C.: Evaluation of adjunctive radiotherapy in surgical treatment of endometrial carcinoma 614
Munnell, E. W., and Brunschwig, A.: Five year end-results of irradiation therapy of cancer of cervix uteri at Memorial Hospital 614
Kardash, T.: Sarcoma of the uterus 615
Sauer, H. R., Macmanus, J. E., and Blick, M. S.: Primary malignant neoplasms of vesicovaginal septum 615
Ormond, J. K., and Best, J. W.: Prognosis of testicular tumors 615
Leucutia, T., Evans, W. A., and Cook, J. C.: Radiation therapy of malignant tumors of the testis 616
Hawley, S. J.: Rotation therapy 616
Kaplan, I. I., and Etkin, S. I.: Treatment of deep-seated malignant tumors with multiple port technic simulating rotation therapy 616

ROENTGEN DIAGNOSIS

HEAD

McGregor, M. The significance of certain measurements of the skull in the diagnosis of basilar impression. *Brit. J. Radiol.*, April, 1948, *21*, 171–181.

Primary basilar impression is a congenital anomaly resulting in upward dislocation of the upper cervical segments in relation to the cranium. Secondary basilar impression is a similar condition based on osteoporosis, delayed or faulty ossification, bone destruction or trauma. The diagnosis can be established only by roentgen methods.

The best single index of basilar impression is Chamberlain's line, from the dorsal tip of the foramen magnum to the dorsal margin of the hard palate. Projection of the odontoid above this is abnormal. A more satisfactory modification of this has as its posterior extemity the most caudal point of the occipital curve.

The basal angle is included between lines connecting the center of the pituitary fossa with the mesion and the anterior lip of the foramen magnum. The normal value is 135 degrees ± 10 degrees. This has been thought of as a good index of basilar impression but it is actually inconstant, and basilar impression may exist with a normal basal angle. On the other hand, a small number of patients have been observed and comparison made of their measurements and symptoms, and it is suspected that the basal angle is a good criterion for prediction of symptoms. In advanced basilar impression with a normal basal angle there are no symptoms; with an increased angle, symptoms are to be expected.

The author suggests that platybasia be restricted to an increased basal angle and upward dislocation of the odontoid be described as basilar impression.—*E. F. Lang, M.D.*

NECK AND CHEST

Haight, Cameron. Congenital tracheo-esophageal fistulas without esophageal atresia. *J. Thoracic Surg.*, Oct., 1948, *17*, 600–612.

Congenital tracheo-esophageal fistula without atresia of the esophagus is rare, having been found in approximately 3 per cent of a series of 65 cases of anomalies of the esophagus observed by the author. The symptoms are choking and coughing coincident with the ingestion of feedings, particularly with the ingestion of liquids.

The roentgen examination should be done with the patient in the prone position. This position causes the fistula to be dependent in its relation to the esophagus, thereby allowing the iodized oil to enter the trachea by gravitation. A suggestive but not diagnostic sign is the presence of an unusually large amount of air in the stomach or intestines. The gastric dilatation becomes evident when the infant cries or strains, appearing to be due to an increase of intratracheal pressure in the presence of a closed glottis and the expulsion of air into the esophagus and stomach.

Tracheoscopy, esophagoscopy, or both, should be used in cases in which the anomaly is suspected. Because of its rarity and past difficulties in establishing the diagnosis, operative correction has been employed in only one previously reported patient. The author reports the case of a four year old child in whom the fistula was corrected.—*Frederick M. Reis, M.D.*

Hueber, Franco, and Gaja, Clemente. L'indagine stratigrafica nella diagnostica di malattie poco communi dello scheletro laringeo. (Stratigraphy in the diagnosis of less common diseases of the larynx.) *Radiol. med.*, March, 1948, *34*, 129–138.

The authors are of the opinion that laminagraphy of the larynx in the anteroposterior projection is a valuable adjunct in the study of the less common diseases of this organ. Admitting that the cartilaginous elements of the larynx per se are not visualized, it is indicated that lesions of these elements reveal themselves indirectly by disturbing or altering the normal soft tissue outlines of the larynx as seen in stratographic examinations. Three unusual case histories with roentgenograms are included. These include luxation of the arytenoid cartilage, arthritis of the cricoarytenoid cartilages and dislocation of the thyroid cartilage.—*Anthony C. Galluccio, M.D.*

Kinsella, Thomas J., Morse, Russell W., and Hertzog, Ambrose J. Spontaneous rupture of the esophagus. *J. Thoracic Surg.*, Oct., 1948, *17*, 613–631.

Spontaneous rupture of the esophagus is a grave lesion especially because the origin of the difficulty is almost never suspected as there is usually nothing to suggest an esophageal lesion, and the patient is frequently in such desperate condition as to be unable to tolerate any surgical procedure. The characteristic

clinical picture is described and the differential diagnosis discussed. The most frequent misdiagnosis encountered has been that of ruptured peptic ulcer. The mediastinal emphysema, which is present in more than 60 per cent of the reported cases, should help to make the correct diagnosis.

The earliest findings on the roentgenograms are the presence of emphysema in the mediastinum, localized at first, later more extensive, involving the whole mediastinum, and eventually fanning out as subcutaneous emphysema in the cervical region.

Other important roentgenologic findings are: the demonstration of a fluid level in the mediastinum, pneumothorax on one or both sides, most frequently on the left, and a fluid level within this pneumothorax pocket. The absence of subphrenic air or gas helps to rule out perforation of a subphrenic hollow viscus. If further evidence is required, it may be obtained by orally administered barium or iodized oil. The iodized oil is easier to remove from the surgical field subsequently, but the risk of iodism must be remembered. Aspiration of characteristic fluid from the pleural cavity confirms the diagnosis.

Spontaneous perforation of the esophagus may occur from pressure of vomiting through a normal structure, or from erosion, ulceration and dilatation. The treatment is discussed and 5 cases of spontaneous perforation of the esophagus presented by the authors.—*Frederick M. Reis, M.D.*

Roemmich, William, Weber, Francis J., Hill, Frank J., and Amos, Lucille. Preliminary report on a community-wide chest x-ray survey at Minneapolis, Minnesota. *Pub. Health Rep.*, Oct. 1, 1948, *63*, 1285–1290.

During an intensified chest roentgen survey in Minneapolis, Minnesota, 306,020 examinations were made using 70 mm. roentgen units. Of the films 1.5 per cent were excluded because of unsatisfacotry quality. Of the examinations 96.6 per cent were "negative" and 3.4 per cent required further study with 14 by 17 inch films and clinical investigation. Of the 3.4 per cent, 2 per cent were suspected tuberculous and 1.4 per cent were suspected other chest diseases. Eight hundred forty-one "cardiacs" were not investigated by large films.

Appointments were given 9,236 for 14 by 17 inch chest films and within five months 8,333 had responded. Of this group, 28 per cent were regarded as essentially negative, 46.2 per cent were suspected of having tuberculosis and 25.8 per cent were suspected of having other diseases. Utilizing the 6,002 cases remaining after excluding the 2,331 negative chest films, the authors found 64.1 per cent (3,850 cases) suspected tuberculosis and 35.9 per cent suspected other pathology. All cases considered "positive" on 14 by 17 inch film findings were referred to private physicians (70 per cent) or public health center clinic (30 per cent). Checked against the local tuberculosis case registery, only 9.2 per cent (353 persons) were found to be registered. At the time of making this report, 1,500 returns had been made out of the 6,000 referrals. Of the 1,500 returns, 648 (43.2 per cent) were diagnosed as positive for tuberculosis; 428 by bacteriological study, and 220 not examined bacteriologically. Of the 648 cases 98 were found to be active and of these only 9 were registered; 6 were on the active list and 3 on the inactive list. An additional 9 cases with active tuberculosis admitted history of disease but were not known to the local authorities.

Thus 80 new cases (with complete returns not in on the entire investigation) of active pulmonary tuberculosis were found by mass survey; 25 had neither contact nor symptoms and could have been found only by mass investigation, such as that conducted, or by fluoroscopic or tuberculin testing methods. Of these cases 55 had symptoms presumably related to their tuberculosis. Analyzing still further, only 3 of the 80 new cases discovered could have been found through contact examinations.

Within six months of completion of the actual mass survey (making of the 70 mm. films) 55 of the 98 persons with active tuberculosis had entered a sanatorium; of these 30.9 per cent were minimal, 56.4 per cent moderately advanced, and 12.7 per cent far advanced. No one was excluded from sanatorium care on basis of bed shortage.—*Angus K. Wilson, M.D.*

Castaldi, Luigi. L'indagine seriografica nell-'esplorazione radiologica dell'apparato respiratorio. (Serialographic investigation in the roentgenological examination of the respiratory apparatus.) *Radiol. med.*, Feb., 1948, *34*, 65–74.

The author discusses the limitations of both the roentgenoscopic and the roentgenographic methods of investigation of the respiratory

tract and stresses that the two methods should be complementary.

Roentgenoscopy permits the examination of the functioning lung in all and any projections but offers a "twilight" visualization with poor detail.

Roentgenography gives clearer definition of structural detail but is static. It only allows standard positions. Shadows visible in other projections and fleeting images such as seen in the course of contrast studies during fluoroscopy may not be registered on the film.

The serialographic examination of the respiratory tract under fluoroscopic control retains the advantages of both methods and eliminates their disadvantages.

The author mentions the widespread use of spot film devices in the study of the gastrointestinal tract and attributes the first adoption of this method to Busi in 1913.

Perhaps the greatest importance of this method is that the examination is under direct control of the clinician rather than the passive one of a technician.

Principal applications.

1. Comparative studies of doubtful images of the pulmonary markings and of poorly visualized cavities or pseudo-cavities. The differentiation between true infiltrations and normal vascular pulmonary traceries can be facilitated since the former will give more or less constant shadows in the various projections available.

In the study of cavities the method of choice is stratigraphy. The serialographic examination is of great aid since the region can be studied in all projections.

2. Visualization of pleural adhesions during pneumothorax. Accurate determination of the number, form, type, and thickness of pleural bands can be obtained and is of great value preceding a resection by the Jacobaeus operation.

3. Bronchography of limited areas. Studies of specific portions of the bronchial tree following instillation of the iodized oil under fluoroscopic control is possible.

4. Roentgenologic control of treatment by the method of endocavitary aspiration described by Monaldi.

This can be practiced directly or by contrast study. The cavity can be filled under roentgenoscopic control and detailed information can be obtained as to its size, shape, drainage, bronchial communications and fistulous tracts. —*Anthony A. Blasi, M.D.*

Giannardi, Goffredo. Saggio di anatomia radiografica del timo normale col penumomediastino. (Study of roentgenographic anatomy of the normal thymus with pneumomediastinum.) *Radiol. med.*, Jan., 1948, *34*, 27–41.

The author points to the difficulty in the accurate evaluation of thymic enlargement by roentgenography.

The determination of the size of the thymus has been estimated by variations in the normal size and shape of the superior mediastinum in the frontal projection, and in changes in the retrosternal space in the lateral projection.

A factor of error is introduced by the great normal variations in size and shape of the thymus. In the evaluation of the appearance of the superior mediastinum certain factors must be considered: (1) position of patient; (2) age of patient; (3) habitus; (4) physical state (respiratory phase, etc.).

The possibility that alteration of the size and shape of the mediastinum may be due to enlargement of structures other than the thymus and to the presence of pathological processes, must be recognized.

The author presents a series of 11 cases in which pneumomediastinum was done on autopsy material in an attempt to establish roentgenographic criteria for the normal thymus.

Condorelli's technique was followed. The technique for the production of the penumomediastinum is not described.

The frontal projection following pneumomediastinum did not give significant findings. In the lateral projection, the retrosternal space was clearly demonstrated.

The posterior margin of the retrosternal space is formed by the ascending aorta, the pulmonary conus and the anterior surface of the right ventricle.

In a preliminary examination, without contrast material, the normal thymus was never definitely visualized. Following the pneumomediastinum, a small band-like opacity of a variable thickness and of modest dimensions, directed craniocaudally could be identified in the retrosternal space.

On dissection in a site corresponding to that of the shadows described, in some cases the thymus was found. In other cases, structures

which consisted of involuted thymic tissue and adipose tissue, and sometimes fibrous adipose tissue alone were demonstrated.—*Anthony A. Blasi, M.D.*

Adams, W. E. Differential diagnosis and treatment of congenital cystic malformation of the lung. *Dis. of Chest*, Jan., 1949, *15*, 60–71.

The author's series of 30 cases from infancy to fifty-nine years of age is compared with 26 additional ones collected for differential diagnosis of congenital cystic malformation of the lung. The symptomatology results from: (1) symptoms secondary to infection of the cysts, and (2) ones due to overdistention of the cysts with changes of the intrathoracic pressures. In the first group, 27 cases show superimposed infections incorrectly diagnosed as followed: bronchiectasis, lung abscess, empyema, tuberculosis, pneumothorax, pneumonitis, and diaphragmatic hernia. Three cases demonstrate the pressure symptoms due to expanding cysts. Pathologically, the simple or multiple cysts show ciliated epithelium with inflammatory elements. Illustrative cases are presented showing how the correct diagnosis, made early, might have reduced the length of morbidity and patient incapacitation. Treatment consisted of surgical resection of the involved area without resultant mortalities. The author stresses the value of fluoroscopic and roentgenographic examination, along with the clinical course, as diagnostic measures for congenital cystic lung disease.—*Frederick R. Gilmore, M.D.*

Walker, J. M., Taggart, W. B., and Staton, H. J. Tension type of congenital pulmonary cyst. *J. Pediat.*, Nov., 1948, *33*, 601–608.

Large tension type congenital pulmonary cysts are rare but are now surgically correctible. The authors report such a cyst successfully removed from a four month old infant.

In 1946 Gross listed four methods of relieving respiratory embarrassment in this condition:

1. Introducing a needle into the cyst.
2. Introducing a trocar and catheter for continued aspiration.
3. Marsupialization of the cyst onto the chest wall.
4. Enucleation of the cyst or removal of the containing lung tissue.

The author's case was a full-term male infant at birth. The child always appeared to breathe rapidly. Four months after birth the breathing became more rapid and labored. The child appeared cyanotic and the right thorax appeared larger than the left, and a hyperresonant percussion note was obtained on the right side. Roentgenograms showed a large air-containing sac filling the right thorax. The cyst was in the anterior position on the lateral film. The cyst was decompressed by a needle with a tube attached and an under-water connection. On the following day the needle was replaced by a catheter. Successful decompression of the cyst was maintained for ten days and then it was surgically enucleated. Recovery was uneventful.

Congenital tension cysts of the lung are bronchogenic cysts arising in pulmonary tissue, through a developmental abnormality. Continuity with the bronchial tree may or may not be present. The cysts are lined with ciliated columnar epithelium and have smooth muscle and elastic tissue in their walls. Cartilage and mucous secreting glands are often present. The inflammatory cyst has a fibrous tissue lining. Secondary infection of a congenital cyst may destroy the lining membrane and make differentiation difficult.

Congenital cysts are usually small and asymtomatic. Occasionally a ball-valve mechanism may cause sudden rapid enlargement.

The differential diagnosis must include congenital diaphragmatic hernia, which can be ruled out by oral barium administration; emphysematous blebs of the lung, which are usually thin walled and on a pleural surface; and tension pneumothorax.

The authors discuss surgical measures for the correction of these cysts.—*Rolfe M. Harvey, M.D.*

Ortmayer, M. Cystitis emphysematosa; with a report of the twelfth human case diagnosed at cystoscopy. *J. Urol.*, Nov., 1948, *60*, 757–762.

About 50 cases of human cystitis emphysematosa have been described in the literature. Approximately four-fifths of these are autopsy reports. The etiology is controversial. Redewill divided the etiology into four groups:

1. Anaerobe gas-formers producing generalized virulent infections, terminating fatally with fulminating bladder emphysema.

2. A gas-forming colon bacillus producing cystitis and involving the mucosa and submucosa.

3. A bacterial cystitis emphysematosa in diabetics with hyperglycemia, over 200 mg. per 100 cc., the gas being the result of enzyme action in the bladder mucosa and submucosa.

4. Air or gas-forming bacteria introduced under the mucosa by trauma or by instrumentation.

Bloody frequent micturition is the common presenting symptom. In the roentgenogram, a ring of air may be seen outlining the bladder. Most of the cases were found at cystoscopy.

The author describes the cystoscopic appearance of the bladder mucosa in her case and reproduces films showing multiple negative shadows about the bladder periphery on a cystogram due to submucosal air-containing blebs. Her patient was a diabetic.—*Rolfe M. Harvey, M.D.*

Smith, Charles Edward; Beard, Rodney Rau, and Saito, Margaret Taiko. Pathogenesis of coccidioidomycosis with special reference to pulmonary cavitation. *Ann. Int. Med.*, Oct., 1948, *29*, 623–655.

After an incubation period ranging from one to three weeks, symptoms develop in approximately 40 per cent of infected males. However, three-fifths of the infections are completely asymptomatic. The pneumonic or respiratory symptoms which occur in two-fifths are of varying degrees of severity. Among females an increased frequency of erythema nodosum results in a somewhat higher proportion of clinically manifest disease. This erythema nodosum is a complication of the initial infection associated with the hypersensitive state.

Pleural effusion is another occasional complication which occurs relatively soon after the infection is acquired. Even though the fungus is usually recoverable from the pleural fluid, the infection is rarely progressive. A third complication of the primary infection may be pulmonary cavitation and even spontaneous pneumothorax or hydropneumothorax.

Its clinical manifestations are well known: extrapulmonary lesions of lymph nodes, bones, joints, central nervous system, peritoneum, genital tract, skin, mucous membranes of the mouth, indeed, of all organs and of all degrees of severity. The mimicry of extrapulmonary tuberculosis is notorious, as is the 50 per cent case fatality.

None of the many thousands of service men who were coccidioidin reactors when given their routine test on arrival at their stations was ever known to have undergone dissemination. Disseminations occurred only in those who arrived uninfected, acquired infection and then disseminated.

Coccidioidal pulmonary cavitation, first reported in isolated instances, is now familiar. The thin wall with little reaction around may cause confusion with lung cysts.

There is general agreement that cavities may develop early in the course of the primary illness, often beginning within the pneumonic lesion in a week or two of the onset. On the other hand, the single or multiple pneumonic areas may reduce in size to nodular or irregular residuals over a period of weeks or months. The patient may be completely over his clinical illness with sedimentation rate normal and serologic tests waning. Then an excavation may develop and a cavity rapidly form.

The cavity may appear transiently during the acute infection and thus be missed. The cavity may develop months after the acute infection is over. Thus the association with the initial infection is readily overlooked. Moreover, cavities may develop after completely inapparent infection. Few cavities produce sufficient symptoms to warrant consulting a physician and his ordering a roentgenogram.

Ninety per cent of the cavities were single and 70 per cent were located in the upper chest.

In treating cavities, one must realize that while many cavities close quickly, a considerable proportion may remain open for many years, rarely producing serious health problems. Bed rest doubtless aids in closing cavities early in their evolution, but has limited value later. The risk of dissemination being negligible and possibility of contagion very remote, drastic intervention should be reserved for specific indications.—*Eugene J. McDonald, M.D.*

Mackie, Thomas T. Parasitic infection of the lung. *Dis. of Chest*, Nov.-Dec., 1948, *14*, 894–905.

The author stresses the importance of protozoan and metazoan parasites as causes of clinical infection within the respiratory tract, especially since many Americans have been exposed recently to these diseases. He briefly outlines the characteristics and cyclic growth of each organism plus the pulmonary sequelae. *Plasmodium falciparum*, for one year in Panama military hospitals, caused 3.7 per cent of malaria patients to have malarial pneumonitis. *Entameba histolytica* is primarily associated

with colonic and hepatic infection, but occasionally involves secondarily the lung by perforation and direct extension of an hepatic abscess through the diaphragm.

The round worms, especially the hookworms, in migrating through the lungs, produce minute hemorrhagic lesions of the alveoli with occasional frank hemoptysis. *Ascaris lumbricoides*, being larger, may mechanically block the capillaries, with subsequent hemoptysis and pneumonitis. Trichinosis infections of lung show no specific pathology and any pneumonitis is probably bacterial in origin. The lung fluke, *Paragonimus westermani*, is the cause of endemic hemoptysis in certain geographical areas, by an inflammatory reaction with cyst formation and necrosis. Actual putrid abscess cavities or atelectasis may result which simulate clinical bronchiectasis. *Schistosoma japonicum* may produce multiple granulomatous lesions and abscesses which roentgenographically appear like miliary tuberculosis. With hydatid cyst formation in the lung, the *Echinococcus granulosa*, a dog tapeworm, may cause a malignant alveolar type cyst, which by trauma, may spread viable scolices via the blood stream with fatal consequences. The unilocular hydatid cysts are diagnosed roentgenographically by the presence of daughter cysts within the primary lung cyst wall, and have a better prognosis.—*Frederick R. Gilmore, M.D.*

Machle, Willard. Pathogenesis of industrial pulmonary disease. *Radiology*, June, 1948, *50*, 755–759.

The author limits the discussion to subacute and chronic pulmonary disease resulting from agents in particulate state and of sufficiently low solubility to be capable of producing chronic rather than acute disease. After inhalation the dust particles are picked up by phagocytes, enter the lymphatics, migrate toward the hilar nodes and pleura and in part reach the general circulation through the thoracic duct. Local accumulations of dust occur in the periphery because of the death of the phagocytes. Peripheral accumulations will be prominent if the mass of incoming dust exceeds the drainage capacities of the lung. Following a very short period of inhalation of irritant dust, bronchiolar constriction, which, if continued, leads to stasis of secretions, patchy atelectasis and emphysema, results in reduction of pulmonary volume and increase in rate. Local deposits in the lungs at first occur in the upper portions and the diaphragmatic surfaces remain free.

The old idea that pneumoconiosis resulted from the sharpness or the physical characteristics of the particles is not considered accurate. At the present time the solubility of the particle is considered the factor of importance, although other factors which influence the range of solubility should be considered.

The three conditions upon which the development of chronic pulmonary disease depend are: (1) chemical characteristic of the dust; (2) solubility rate of the particles within certain ranges; (3) adequate concentration of dust exposure continued for a sufficient period of time. Previous pulmonary infections and exposure to irritants, the piling up of phagocytes and obstruction by fibrous tissue will affect lymphatic drainage and the rate of development of pulmonary disease. While attention has been centered on the lungs, it should be recalled that considerable material will be carried by the general circulation to the liver, spleen, kidneys and bone marrow and the effects on these organs should be considered.—*J. N. Ané, M.D.*

Shaver, Cecil Gordon. Further observations of lung changes associated with the manufacture of alumina abrasives. *Radiology*, June, 1948, *50*, 760–769.

This is a report of 34 well established and 38 early cases of lung involvement encountered in certain men employed in the manufacture of alumina abrasives. The longest period of exposure was nineteen years and the shortest was eighteen months. While the disease was present previous to World War II, it was not recognized. Seven patients who were in desperate condition when first seen died within a relatively short period of time. It has been shown that once the disease becomes well established, progression and complete disability occur rapidly. One man who left the employment of the plant with a negative chest film showed evidence of disease one year later.

Cough, shortness of breath, pleuritic and substernal pain, and dark colored sputum were the symptoms noted in the well established group. The early cases are relatively free of symptoms and show practically no abnormal findings on chest films. Associated acute pulmonary infection has been found to play no major part in the progression of the disease.

Roentgen findings consisted of pneumothorax, emphysema, localized pleural effusion, widened mediastinal shadow, diaphragmatic adhesions and granular opacities in the upper portions of the lung fields. At fluoroscopic examination, in the presence of marked fibrosis, instead of the usual widening of the mediastinum on expiration and narrowing on inspiration, the opposite or paradoxical movement is noted.—*J. N. Ané, M.D.*

Wilson, Stanley A. Delayed chemical pneumonitis or diffuse granulomatosis of the lung due to beryllium. *Radiology*, June, 1948, *50*, 770–779.

Exposure to beryllium occurs in beryl mines, in the extraction of beryllium from the ore, in the production of salts and oxides of beryllium, in plants employing beryllium in alloys, in the coating of fluorescent, neon and radio tubes, and in chemical, pharmaceutical and research laboratories. The cases of acute pneumonitis were characterized by insidious onset, cough, dull, burning substernal pain, dyspnea, cyanosis and anorexia. The roentgen findings consisted of a diffuse haziness or ground-glass density similar to pulmonary edema one to three weeks after the onset of symptoms. This was followed by areas of soft infiltration similar to those seen in bronchial pneumonia with enlarged hilar structures and exaggerated lung markings. As these areas absorbed small nodules were noted which remained from one to four months. One or two cases showed some residual linear fibrosis.

In the chronic form, granular densities were associated in the next stage with a diffuse reticular pattern. In stage three, there was nodular involvement associated with hilar enlargement and small areas of emphysema.

In the differential diagnosis, pulmonary sarcoidosis, miliary tuberculosis, silicosis and other pneumoconioses must be considered. The pulmonary changes noted in erythema nodosum may be confusing but the skin involvement in this disease is typical. In virus pneumonia, the involvement throughout both lung fields is not usually uniform.—*J. N. Ané, M.D.*

Bergmann, Martin, Shatz, Burton A., and Flance, I. Jerome. Apical pulmonary carcinoma and tuberculosis. *J.A.M.A.*, Nov. 13, 1948, *138*, 798–801.

The differentiation of apical pulmonary tuberculosis from apical pulmonary carcinoma is often difficult. Fifty-two per cent of all carcinomas of the lung occur in the upper lobes.

Previously, tissue for diagnostic study has been obtained by exploratory thoracotomy, needle aspiration or bronchoscopy, which are drastic, difficult and inadequate methods. The authors emphasize the value of examination of sputum, particularly in apical lesions, which will yield a positive diagnosis in from 60 to 88 per cent of carcinomas of the lung.

Three case histories are reported demonstrating the definite value of sputum examinations for tumor cells.

Gardella, Giovanni. Le alterazioni dello scheletro toracico nella diagnosi dei tumori pulmonari. (Alterations in the thoracic cage in the diagnosis of lung tumors.) *Radiol. Med.*, March, 1948, *34*, 146–158.

The author calls attention to the role that alterations of the osseous components of the thoracic cage can play in the differential diagnosis of pulmonary tumors. They are most often manifest by compression effects (contiguity) or destructive, osteolytic metastatic implants involving the ribs or dorsal vertebrae. Such findings serve to focus attention on the presence of a pulmonary neoplasm and also serve to help differentiate as to the benign or malignant nature of the primary lesion. For example, aneurysm, tuberculosis, Pancoast tumor, osteosarcoma and ganglioneuroma are considered with respect to how they may alter the thoracic cage and the dorsal spine. In a series of 40 cases, 10, or 25 per cent, presented significant rib or dorsal spine abnormality. This seems to be a rather high figure. The author justly stresses the importance of minutely inspecting each rib in cases suspected of pulmonary neoplasm and the necessity for Potter-Bucky films as well as multi-angle roentgenograms. The accompanying illustrations and the bibliography are very commendable.—*Anthony C. Galluccio, M.D.*

Crimm, Paul D. Spontaneous collapse. *J. Thoracic Surg.*, Oct., 1948, *17*, 662–680.

The author analyses the continuity of interstitial, mediastinal and subcutaneous emphysema. The few cases reported in the literature are reviewed and 2 cases are added.

The etiology, diagnosis and treatment of spontaneous collapse of the lung with air or blood are discussed. The most common etiologic

factors in the production of spontaneous pneumothorax in the healthy individual are emphysematous blebs in the pleura, while tuberculosis is the cause in the majority of cases of pathologic spontaneous pneumothorax.

Indirect pulmonary pneumoperitoneum is extremely rare. It has occurred following pneumothorax and during anesthesia, where excessive pressure has been the etiologic factor. A suspected fistula was the cause in a case of pneumonia of the left lower lobe and in another patient with tuberculosis it followed a left thoracoplasty. A valve-like fistula permitted leakage of air into the peritoneal cavity in the latter case.

Finally, spontaneous lung collapse, caused by the presence of extraneous air, is differentiated from the airless lungs in acquired collapse.—*Frederick Reis, M.D.*

Blades, Brian. Empyema. *J.A.M.A.*, Nov. 27, 1948, *138*, 943–946.

Since the advent of effective chemotherapy and antibiotics, empyema has become rare. Early parenteral and intrapleural use of penicillin aborts frank abscess formation in many cases, but sterile empyema is not cured empyema. Sterile pus may even produce empyema necessitans. There is still a tendency to mistake empyema for unresolved pneumonia. After weeks or months, bacteria attenuated by the antibiotic may revive and produce an active pyogenic infection. Penicillinase should be used in the laboratory to help identify organisms in aspirated pleural fluid from patients already under penicillin effect. Precise bacteriologic diagnosis is important to select patients who require streptomycin (tuberculosis, hemolytic influenza bacillus, Friedländer's bacillus and a few rare gram-negative bacteria).—*John Turner, M.D.*

Carson, M. J., Burford, T. H., Scott, W. G., and Goodfriend, J. Diagnosis of pulmonary stenosis by angiocardiography. *J. Pediat.*, Nov., 1948, *33*, 525–543.

The authors have found angiocardiography to be of value, particularly in the exact diagnosis of cyanotic congenital cardiac conditions. One of the authors has developed the tautograph, which is capable of making ten exposures in ten seconds, to facilitate the procedure of angiocardiography.

The patients fast for four hours preceding the examination. General ether anesthesia is used in younger patients and local novocaine in older patients. Patients with cyanotic heart disease are given preoperative subcutaneous fluids plus concomitant oxygen with the anesthetic. The antecubital vein is cut down on and a few minims of 70 per cent diodrast is given after patency of the cannula has been determined by saline drip. If no reaction occurs the injection is completed, 10–18 cc. being used in infants up to two years of age, 20–30 cc. between the ages of two and ten, and 30–40 cc. up to fifteen years. The injection should be completed in two seconds.

The most useful views are the anteroposterior and left anterior oblique. Illustrative films are presented showing the visualization of the normal cardiac chambers and great vessels in these two projections. Following these illustrations various congenital cardiac anomalies are demonstrated by angiocardiography. These include non-functioning right ventricle with tricuspid stenosis, persistent truncus arteriosus, and tetralogy of Fallot.

The salient features of the tetralogy which may be demonstrated by angiocardiography include: (1) defect in the interventricular septum allowing medium to pass directly from the right to the left ventricle; (2) the presence of an overriding aorta as shown by simultaneous opacification of the aorta, pulmonary conus, and pulmonary arteries; (3) enlargement of the right ventricle, and (4) decreased size of the pulmonary arteries.

In the case of a non-functioning right ventricle with tricuspid stenosis angiocardiography will show opaque material passing from the right auricle to the left auricle with no visualization of the right ventricle.

In persistent truncus arteriosus with stenosis of the pulmonary arteries angiocardiography shows: (1) a much enlarged right ventricle; (2) a patent interventricular septal defect; (3) an overriding truncus, and (4) no pulmonary conus with small pulmonary arteries arising from the truncus.

The original article should be consulted in order to appreciate the excellent demonstration of these anomalies by angiocardiography by these authors.—*Rolfe M. Harvey, M.D.*

ABDOMEN

Cave, Paul. Stomach in femoral hernia. *Brit. J. Radiol.*, March, 1948, *21*, 143–145.

This is the report of a case of a short woman with a femoral hernia who was examined with

a barium meal. During the examination the stomach and duodenum were observed to descend to a position in the left thigh in a femoral hernia. The position of the stomach permitted unusually satisfactory palpation during the examination. The gastric emptying time was normal. The patient complained of discomfort after meals or on standing or walking for long periods, but relief was immediate on lying down. The patient did not wear a truss and did not desire an operation.

A similar condition was reported in 2 patients in German literature in 1920, and a third was quoted, but the present case is the first in English and the first shown with a barium meal. The others were sudden in onset, followed trauma or exertion, and occurred in patients with a pre-existing femoral hernia. They were treated successfully surgically.—*E. F. Lang, M.D.*

Bralow, S. P., Scheinberg, S., and Necheles, H. Peptic ulcer and pregnancy. *Am. J. Digest. Dis.*, May, 1948, *15*, 137–141.

It has been believed for many years that during pregnancy peptic ulcer rarely appears, rarely flares up and often heals. Gastric acidity tends to be decreased during pregnancy, but theories of mechanical and humoral factors producing this decrease are vague. Four clinical cases of ulcer complicating pregnancy are reported, of which 2, with no previous ulcer history, had serious episodes of hemorrhage. The authors believe that obstetricians should not feel safe in view of the reported rarity of the co-existence of peptic ulcer and pregnancy, but should study carefully all cases of persistent heartburn, epigastric distress, etc., in their patients, as peptic ulcer may produce serious complications during or shortly after pregnancy.

It is felt the number of ulcers observed in pregnancy may increase if the obstetrician is impressed with their possible co-existence and keeps this in his mind, when obstetric patients complain of symptoms that may be due to pregnancy as well as to peptic ulcer.—*Franz J. Lust, M.D.*

Bassler, Anthony, and Peters, A. Gerard. Distinctions between gastric sarcoma and carcinoma, with special reference to the infiltrating types of sarcoma. *J.A.M.A.*, Oct. 16, 1948, *138*, 489–494.

This article is based on a series of 20 proved cases of advanced sarcoma of the stomach. The authors are concerned with signs, symptoms and laboratory findings which could aid in making a preoperative diagnosis of gastric sarcoma. These findings are compared with similar features found in advanced gastric carcinoma. The authors believe that sarcoma of the stomach could be diagnosed more often. In 11 of the 20 cases reported (55 per cent) a presumptive diagnosis of sarcoma was made.

Ewing's classification of gastric sarcoma is used by the authors: (1) spindle cell myosarcoma, (2) lymphosarcoma, (3) miscellaneous round cell or mixed cell alveolar sarcoma. Of these, lymphosarcoma is said to comprise about 60–65 per cent of sarcoma encountered in the stomach. Eleven (or 55 per cent) of the author's series were lymphosarcoma.

The authors are impressed by the surprising wellbeing of a patient with advanced sarcoma. In their group of 20 patients, 12 (60 per cent) were employed at the time of examination.

The authors believe there are points of difference in the roentgen findings of these two malignant diseases of the stomach. Some of the gastric deformities to be observed in sarcoma include the following: (1) a rounded, well defined endogastric mass, bearing a demonstrable ulcerative niche; (2) a tumor arising on the greater curvature, even when it has the typical saucer shape of carcinoma; (3) giant rugae; (4) diffuse decrease in the size of the stomach; (5) absent or few "thumb indentations" characteristic of carcinoma, with the irregularity in gastric outline consisting of shallow serrations involving the stomach to considerable extent.

In conclusion the authors state that "in favor of a diagnosis of gastric sarcoma as compared to carcinoma in an average way," the following points are noted:

1. Average age for sarcoma is 38.5 years; in carcinoma it is fifteen years older.

2. Because of slowness of the growth, sarcoma may extend twice or even three times longer than carcinoma.

3. There is no relationship with peptic ulcer in sarcoma.

4. Weakness in cases of sarcoma is less than half that of carcinoma.

5. Loss of weight is about one-third that noted in carcinoma. In sarcoma there may be only slight anemia or none. In carcinoma it is more definite.

6. No jaundice is present in sarcoma; in

carcinoma it occurs in 23.2 per cent.

7. Palpable tumor in sarcoma is a little more than half as common as in carcinoma. The sarcoma masses are vague and doughy in consistency, whereas in carcinoma, generally, the mass is easily felt and firm to hard in character. Visible peristalsis is not noted in sarcoma.

8. The spleen is enlarged in 15 per cent of the cases of sarcoma and not present in carcinoma.

9. Virchow's gland is not observed in sarcoma.

10. Hydrochloric acid of the free and combined types was present in 75 per cent of the cases of sarcoma; this figure is much higher than that found in carcinoma.

11. Blood in gastric contents and stools is observed in one-third of the cases as compared to carcinoma.

12. The gastroscope is less valuable in diagnosing sarcoma than carcinoma.

13. Roentgenograms are valuable in both conditions, although less so in sarcoma than in carcinoma.

14. Roentgen evidence suggestive of sarcoma is present in 55 per cent of the cases.—*R. F. Niehaus, M.D.*

Conti, James G., Jr., Foltz, Thomas P., and Stevens, G. Arnold. Surgical and roentgenologic aspects of duodenal diverticula. *J.A.M.A.*, Oct. 9, 1948, *138*, 403–405.

The authors report 3 cases of duodenal diverticula which were operated upon with removal of the diverticula and complete relief of their symptoms. They believe that patients with a history of dyspepsia, characterized by pain and fullness after meals, in whom diverticula can be demonstrated roentgenologically, should be entitled to surgical extirpation of the lesion, if other causes are eliminated. They conclude that the majority of duodenal diverticula do not produce symptoms and require no treatment but that some diverticula of the duodenum produce symptoms that may be cured by surgery.—*C. Peter Truog, M.D.*

Reid, Douglas R. K. Argentaffinoma of the gastro-intestinal tract. *Brit. J. Surg.*, Oct., 1948, *36*, 130–139.

Twenty-five cases of argentaffinoma are presented. Seventeen of these involve the appendix, 6 the ileum, and 1 each the colon and stomach. The incidence, pathology, and treatment of the tumor are discussed.

The author states that it is not possible to distinguish whether these lesions are benign or malignant on histopathological grounds alone. It is probably sounder to regard all carcinoids as potentially malignant and to classify them according to their behavior as localized, invasive, or metastasizing. Malignancy from appendicular carcinoid is extremely rare, only 17 cases having been reported. Extra-appendicular tumors occurring usually later in life are much more prone to display obvious malignancy. Growth of both primary and secondary tumors is very slow. Metastasis occurs chiefly to the lymph nodes of the mesentery while distant metastases have been found in the liver, and rarely in the retroperitoneal tissues, lung, pleura, brain, spinal meninges, pancreas, and inguinal lymph nodes. None of the 25 cases were diagnosed roentgenographically. The presenting symptom in the cases where the ileum was involved was that of a small bowel obstruction.

The treatment of choice in the benign lesions is local excision. In malignant carcinoid total extirpation is justified wherever possible. It has been suggested that irradiation be attempted on inoperable masses although the response to radiotherapy is not known.—*Charles W. Werley, M.D.*

Glass, W. H. Small intestinal deficiency pattern; current status. *Am. J. Digest. Dis.*, Sept., 1948, *15*, 294–298.

Idiopathic steatorrhea and the disordered motor function of the small intestine, if it be on the same basis, respond to vitamin B complex therapy. Depending on the intensity of the illness, other therapeutic measures as dietary alteration to give adequate caloric intake of assimilable foods, vitamin D in non fat vehicle, and parenteral calcium, if an insufficient amount is absorbed, are, of course, indicated. The basic disease, however, is the alteration of the jejunal mucosa by deficient intake of some factor or factors in the whole vitamin B complex. Other therapy is indicated to treat the bodily changes subsequent to the altered absorption of intestinal content.

Grossly visible steatorrhea only occurs where there is extensive fat and soap content in the stool. In cases studied here, all who demonstrated significant mucosal changes in the jejunum, presented steatorrhea on chemical analysis of the stool. It is concluded that ideopathic steatorrhea is the more advanced phase

of so-called vitamin B complex deficiency pattern. This latter term should no longer be used and Golden's terminology of disordered motor function with a subdivision as to the etiological basis is much the preferred terminology.—*Franz J. Lust, M.D.*

Delario, A. J. X-ray examination of the vermiform appendix. *Am. J. Digest. Dis.*, May, 1948, *15*, 151–161.

Roentgen examination of the appendix may help to lower the mistakes in diagnosis. In 10–15 per cent of cases diagnosed as acute appendicitis a normal appendix is removed at operation. The percentage of appendices removed and not giving relief of symptoms in subacute and chronic appendicitis may be 25–70 per cent. Roentgen examination of the appendix will give data concerning anomalies: size, form, shape, and position of the appendix; its mobility; the presence of kinks, congenital bands and adhesions; its peristaltic action; its filling and emptying; the presence of fecaliths, foreign bodies, opaque stones; and the location of tenderness directly upon the appendix; all of which data cannot be obtained through clinical examination alone. Roentgen examination will disclose secondary signs of early appendiceal disease such as cardiospasm, pylorospasm, duodenal and ileocecal spasm, spasms of both lower ileum and cecum with paralytic distention and atony of these parts in late appendiceal disease.

The technique of the roentgenological exploration is given and the roentgen findings are discussed. Cases are shown of acute, subacute and chronic appendicitis; of appendiceal abscess, tuberculosis of the appendix, diverticula and intussusception, and of benign and malignant tumors.—*Franz J. Lust, M.D.*

Gross, R. E., and Ware, P. F. Intussusception in childhood. *New England J. Med.*, Oct. 28, 1948, *239*, 645–652.

A series of 610 cases of intussusception in infants and children is reported. Mortality rates varied significantly with the duration of symptoms before therapy: less than 24 hours, 0; 24 to 36 hours, 9 per cent; 36 to 48 hours, 13 per cent; more than 48 hours, 15 per cent. There were 180 patients in the group with symptoms less than 24 hours, without a fatality.

While intussusception in adult life usually has a discoverable mechanical cause, such as a bowel tumor or a Meckel's diverticulum, intussusception in early life rarely has an identifiable etiology. In this series, only 5.4 per cent had a discernible mechanical factor: Meckel's diverticulum, 29 cases; intestinal polyp, 4 cases; lymphoma of bowel, 2 cases; duplication of terminal ileum, 1 case.

In the present series, 76 per cent were ileocolic; 14 per cent ileo-ileocolic; 5 per cent jejunoileal or ileoileal; and 2.1 per cent colocolic. Multiple intussusceptions occurred in 0.7 per cent. In 2.2 per cent the site was not stated.

Seventy-two per cent occurred in the first year of life, with the peak incidence between the third and eleventh months, in which 68 per cent of the cases occurred. Eighty-four per cent occurred before the age of two years. Sixty-five per cent of the patients were male.

Onset was usually abrupt, with rhythmic pain in 95 per cent, vomiting in 90 per cent, and blood in the stools in 85 per cent. In about half the cases with blood in the stool, the bleeding was grossly evident. Close to 85 per cent had a palpable abdominal mass. The clinical picture is so characteristic that in only about one-tenth of the cases, in the authors' estimation, is roentgenologic help needed. A plain film of the abdomen may show the intussusceptting mass, with dilated bowel proximal to it. In most cases, the intussusception has progressed to the colon where a barium enema shows the filling defect, and the postevacuation film may show a thin sheet of barium remaining around the intussusception.

While surgery is the treatment of choice in most cases, rapid reduction of the intussusception may often be accomplished by rectal injection of air or barium under fluoroscopic control. Limitations of this method revolve around the possibility of missing an intestinal tumor or Meckel's diverticulum, the lack of usefulness if any part of the intussusception lies above the ileocecal valve, and the uncertainty of complete reduction. It should be done only with the consent and cooperation of the surgeon who will accept the responsibility of operating on the child if the hydrostatic method fails.—*Henry P. Brean, M.D.*

Ravitch, Mark M., and McCune, Robert M. Reduction of intussusception by barium enema. *Ann. Surg.*, Nov., 1948, *128*, 904–917.

This paper presents an excellent discussion of the advantages of reducing intussusception

by means of barium enema. In a series of 27 cases treated previously by barium enema the authors demonstrate no mortality as compared with a 24 per cent mortality for a like series of 21 cases treated primarily by operative reduction. The criteria for successful reduction are (1) entrance of barium well into the small bowel, (2) return of feces or flatus, (3) masses no longer palpable, (4) patient clinically relieved, (5) blood free stool and recovery in stool of charcoal given by mouth.

The authors point out that a review of the literature over the last seventy-five years reveals that reduction of intussusception by hydrostatic pressure has consistently produced a low mortality and is a safer primary approach than surgery. It is not a substitute for surgery but rather the logical first step in the treatment of the condition. The reasons why this method has given superior results are listed as: (1) by fluoroscopic examination the diagnosis is established; (2) the accuracy of diagnosis of complete reduction is high; (3) the 2 per cent rate of recurrence is about the same by either method; (4) the possibility of missing a tumor by barium enema is low for the incidence of tumor is only 2.5 per cent in children under two years who suffer 70–90 per cent of the intussusceptions; (5) the delay caused by an unsuccessful attempt at reduction by enema is usually no more than a half hour; (6) experimental evidence shows that the 3 feet of hydrostatic pressure used for barium enemas will not rupture the bowel or reduce gangrenous bowel.—*T. D. Allison, M. D., and C. L. Hinkel, M.D.*

Mantovani, Dino, and Stranieri, Rodolfo. Un caso di doppia colecisti. (A case of double gallbladder.) *Radiol. Med.*, March, 1948, *34*, 143–145.

The authors describe a case of double gallbladder and double cystic duct visualized by the Graham test. The clinical history is more or less typical of gallbladder colic. Films taken after the ingestion of the dye reveal an elongated, well delineated gallbladder with a well defined cystic duct. In close proximity to this gallbladder which lies anteriorly, a less well-defined second gallbladder shadow is seen. The cystic duct in this case is shorter. What appears to be a common duct is also visualized. It is stated that the lateral view separates these two shadows but this film is not reproduced. This is a roentgenographic and postmortem rarity as some 8 cases have been reported to date. It is not uncommon to see at least part of the cystic duct. The response to the fatty meal was fairly good, though better in the case of the more anterior gallbladder.

The authors advance the theory that the cystic duct of the anterior, better visualized gallbladder, was probably equipped with Heister's valves while the shorter duct was not. Hence there would be a difference in contractability and emptying or function which might be responsible for the symptomatology in this case. Operative findings are not included.—*Anthony C. Galluccio, M.D.*

Comfort, Mandred, W., Gray, Howard K., and Wilson, James M. The silent gallstone; a ten to twenty year follow-up study of 112 cases. *Ann. Surg.*, Nov., 1948, *128*, 931–937.

In a long term analysis of 112 cases of silent gallstones the authors state that approximately half developed symptoms. Of this group only 60 per cent experienced dyspepsia and of these 30–35 per cent had colic, and 5–10 per cent had jaundice. In the best surgical series there has been a 0.5 per cent mortality with asymptomatic patients while the mortality from cholecystectomy increases to 3 per cent after complications arise. No relationship of carcinoma of the gallbladder to silent gallbladder calculi could be shown. Although many surgeons favor operation of all proved gallstones, the authors regard cholecystectomy for these cases as optional. However, surgical intervention should not be postponed after more than mild symptoms appear.—*T. D. Allison, M.D., and C. L. Hinkel, M.D.*

Doubilet, Henry, and Mulholland, John H. Recurrent acute pancreatitis; observations on etiology and surgical treatment. *Ann. Surg.*, Oct., 1948, *128*, 609–638.

With 21 well-documented cases the authors demonstrate the value of section of the sphincter of Oddi as a definitive treatment for recurrent acute pancreatitis. Their studies support Archibald's contention that when a common biliary-pancreatic passageway exists, spasm of the sphincter of Oddi will produce reflux of bile into the pancreas. The diagnosis of acute pancreatitis is readily established by elevation of serum amylase. The quantitative evaluation of pancreatic function can be measured by the flow of pancreatic juice after the intravenous injection of an assayed quantity of secretin.

The absence of a rise in serum amylase during an attack of acute pancreatitis is occasionally seen in cases of long standing disease with fibrosis or calcification of a major portion of the pancreas.

The authors find that N/10 hydrochloric acid applied directly to the papilla of Vater will produce spasm of the sphincter which can be demonstrated by kymographic pressure tracings and cholangiograms through a T tube. Similar studies after the administration of morphine reveal spasm of the duodenal wall with resistance to the flow of pancreatic and biliary juices.

In sectioning the sphincter the approach through the common duct is recommended. After the cutting of the sphincter muscle the spasm is abolished. However, the inherent muscle tone of the duodenal wall remains and prevents reflux of the duodenal contents into the biliary tract. Postoperatively the patients show relief of pain, weight gain and freedom from recurring attacks.—*T. D. Allison, M.D., and C. L. Hinkel, M.D.*

GYNECOLOGY AND OBSTETRICS

Foote, Frank W., Jr., and Stewart, Fred W., The anatomical distribution of intraepithelial epidermoid carcinomas of the cervix. *Cancer*, Sept., 1948, *1*, 431–440.

Intraepithelial carcinomas of the cervix are defined by these authors as any tumor which has not broken through the basement membrane. This definition differs from some writers in that any tumor below the level of the epithelium has been considered to have become invasive. The authors have studied 27 specimens of intraepithelial carcinomas of the cervix by complete serial sections with reconstruction of the extent of the tumor, and on the bases of their findings have made the following observations:

(1) The most reliable biopsy procedure would require four specimens; one from the anterior and posterior lips, and one from each lateral angle of the external os. If a single biopsy is taken from the anterior or posterior lip, the probability of its being positive is approximately 50 per cent.

(2) All such patients would be cured by hysterectomy and the vast majority would have been cured by trachelectomy. The latter operation would require extensive serial sectioning to be certain that the entire tumor had been removed.

(3) They criticize an expressed opinion that in situ carcinomas of the cervix should be observed at frequent intervals rather than be removed. They show convincing evidence that most intraepithelial epidermoid carcinomas will ultimately become invasive.—*W. E. Childs, M.D.*

Solomon, Edwin P., and Loveman, Adolph B. Chancre and carcinoma of cervix; simultaneous occurrence on opposite lips. *Am. J. Obst. & Gynec.*, Oct., 1948, *56*, 694–699.

The authors report a case of chancre and carcinoma of the cervix occurring simultaneously on opposite lips. This type of case is a rarity. The case is reported to emphasize the importance of an accurate etiological diagnosis of cervical erosions and ulcerations. A positive differentiation of simple cervical erosion and carcinoma from chancre cannot be made except by dark-field examination and/or examination of tissue. Recognition clinically is dependent upon a high index of suspicion on the part of the examining physician.—*Mary Helen Cameron, M.D.*

Cohen, Mortimer, and Cravotta, Charles A. Sarcoma of the uterus. *Am. J. Obst. & Gynec.*, Nov., 1948, *56*, 997–999.

Sixteen cases of sarcoma of the uterus were found in a survey covering twenty-five years at the Elizabeth Steel Magee Hospital, Pittsburgh. This represented an incidence of 2.6 per cent of all uterine malignancies. Histopathologically, 7 of the 16 were leiomyosarcomas. Ten started in fibroids and 3 in endometrial stroma. Five patients of this series are still living. Sarcoma was an accidental finding following uterine removal for fibroids in each of the 5 surviving. Fifteen years is the longest period of survival. Metastases were rapid and extensive in 1 patient with uterine sarcoma complicating pregnancy.—*Mary Helen Cameron, M.D.*

GENITOURINARY SYSTEM

Samuel, Eric. Calcification in suprarenal neoplasms. *Brit. J. Radiol.*, March, 1948, *21*, 139–142.

A case of adrenal virilism due to adenocarcinoma of the cortex, in which massive calcification of the tumor was one of the presenting features, is reported. Other possible causes of massive calcification in the left hypochondrium are listed: calcified cysts or tuberculomas of the

spleen, or perisplenitis; infarcts, tumors or inflammatory and toxic conditions of the left kidney; tuberculous lymph glands; aneurysm of the celiac axis or splenic artery; calcified retroperitoneal hematomas or tumors; osteoma, osteochondroma or sarcoma of ribs; suprarenal tuberculosis, or neuroblastoma of the suprarenal body.

In hypernephroma and suprarenal adenocarcinoma the calcification occurs in areas of hemorrhage rather than in the tumor itself.—*E. F. Lang, M.D.*

Braasch, William F., Greene, Laurence F., and Goyanna, Ruy. Renal ptosis and its treatment. *J.A.M.A.*, Oct. 9, 1948, *138*, 399–403.

Renal ptosis is not an abnormal condition and does not cause symptoms per se. It is only when complications develop that symptoms may arise. The majority of the authors' patients were women in the third to fifth decade who were thin and definitely underweight. Twenty per cent complained of urinary symptoms such as frequency, dysuria, and nocturia. Symptoms, as a rule, were ill defined.

Renal ptosis was divided into four grades based on degree of descent. Grade 1, those cases in which renal pelvis is situated opposite the third lumbar vertebra. Grade 2, the pelvis is opposite the fourth lumbar vertebra. Grade 3, pelvis is opposite fifth lumbar vertebra. Grade 4, the pelvis is below the fifth lumbar vertebra.

The incidence of pyelectasis and delayed emptying time was approximately the same in the first three grades of ptosis and *less frequent* in Grade 4, in which ptosis was most marked.

The degree of ptosis had no relationship to the symptoms of the patient.

The urogram is of vital importance. The explanation of the borderline pyelocaliectasis is the "flabby pelvis." The following factors may be present: (1) obstination at or near the ureteropelvic junction; (2) adynamic or atonic dilatation resulting from a previous renal infection; (3) imbalance of the renal innervation, with consequent atony. That pyelectasis, in many cases, is not caused by actual obstination, may be shown by (1) absence of retained fluid in renal pelvis, (2) the absence of retained medium shown in the ten minute delayed film, and (3) surgical exploration. Delayed urograms are made by retrograde injection of contrast medium into the renal pelvis. The catheter is then withdrawn and roentgenograms are made at ten minute intervals. If the opaque medium persists in the renal pelvis fifteen minutes or more after withdrawal of the catheter, the delayed emptying time would indicate inadequate renal drainage. *Unless existence of stasis can be visualized in nephroptosis, surgical intervention is not indicated.*

Nephropexy was performed on 21 patients with primary nephroptosis from 1935 through 1944. The operation was employed only when the patient's symptoms and evidence of renal damage were caused by renal ptosis.

Symptoms were relieved in less than 50 per cent of the carefully selected cases following nephropexy.

The authors conclude that the results make them hesitate before advising surgery and that a conservative attitude should be employed.—*C. Peter Truog, M.D.*

Low, H. T., and Coakley, H. E. Leukoplakia of the renal pelvis. *J. Urol.*, Nov., 1948, *60*, 712–713.

An unusual case of leukoplakia confined to a kidney pelvis without concomitant infection is described by the authors. The patient was first seen with complaints of right renal colic. A right retrograde pyelogram showed a moth-eaten appearance of the minor calyces of the right kidney. On the basis of this finding plus the finding of cornified squamous epithelium in flakes voided in the urine, a preoperative diagnosis of leukoplakia was made. This was confirmed by nephrectomy.—*Rolfe M. Harvey, M.D.*

Culp, O. S., and Hartman, F. W. Mesoblastic nephroma in adults; a clinicopathological study of Wilms' tumors and related renal neoplasms. *J. Urol.*, Oct., 1948, *60*, 552–576.

The authors have attempted to classify embryonal kidney tumors in a more simplified fashion. More than fifty different names have been used in the literature to describe these tumors. The authors suggest the name embryonal nephroma to include all renal tumors of embryonic origin. In turn, these tumors may be subdivided into those of mesoblastic origin (cortex) and those of mesonephric origin (pelvis). The authors further subdivide the cortical tumors into: (1) mixed; (2) carcinoma; (3) sarcoma; and (4) undifferentiated.

Mixed Cell Type. These tumors contain both

epithelial and connective tissue elements with varying degrees of cellular differentiation. The group includes Wilms' tumors. Illustrative case histories and roentgenograms are presented. This group includes the commonest mesoblastic nephromas. The age incidence ranges from sixteen to eighty years. There was no significant difference in sex distribution or site of the lesion between the right and left sides. Eighty-four per cent of the cases had a palpable tumor, 72 per cent had pain, and 53 per cent had hematuria. The known mortality was 82 per cent. The most frequent site of metastasis was the lymph nodes and then the lungs and liver.

Carcinoma. The authors consider embryonal carcinoma to be mixed cell tumors in which epithelial elements dominate the histopathological picture. A few case reports with illustrative films are presented.

Sarcoma. The authors found only one tumor in their group which showed only embryonic connective tissue elements. They feel that most reported sarcomas belong in the mixed cell group. Most reported cases in this group died soon after nephrectomy in spite of post operative irradiation.

Undifferentiated. Most highly malignant cortical tumors can be identified as undifferentiated carcinoma or sarcoma.—*Rolfe M. Harvey, M.D.*

Arnheim, F. K. Carcinoma of the prostate; a study of the postmortem findings in one hundred and seventy-six cases. *J. Urol.*, Oct., 1948, *60*, 599–603.

The material for this study was obtained from 21,718 autopsies performed at the Cook County Hospital from 1929 to 1946. One hundred seventy-six cases of carcinoma of the prostate were found. Ninety-six per cent of these were adenocarcinoma and 4 per cent squamous cell carcinoma.

Thirty-three per cent had no gross metastases. Of the 37 cases in which death was not due directly to carcinoma, 81 per cent had no demonstrable metastases. One-third of the metastases were visceral and the remaining two-thirds were to the bones and lymph nodes. The order of frequency of involvement of the lymph nodes was periaortic, iliac, tracheobronchial and inguinal. Eighty-two per cent of the bone metastases were to the vertebrae, ribs and pelvis. The bladder was involved in 44 per cent of the cases. The youngest age at which carcinoma of the prostate was found was forty-two years. Seventy-seven per cent of the cases were between the ages of sixty and eighty.

The authors feel that metastases must be by way of the vertebral veins as proposed by Batson. They conclude that carcinoma of the prostate is biologically active in some individuals and inactive in others.—*Rolfe M. Harvey, M.D.*

NERVOUS SYSTEM

Smith, C. A. Paraganglioma (pleochromocytoma). *J. Urol.*, Nov., 1948, *60*, 697–701.

The author reports the case of a twenty year old soldier who had been wounded in the chest and extremities in 1944. Physical examination showed marked fluctuation in blood pressure readings. The patient had noticed blanching of the finger tips, especially in cold weather. He had also been told in the past that his blood pressure was high. Physical examination showed the blood pressure 180/100 in the right arm and 160/98 in the left arm. Cold pressor tests with sedation and ergotamine showed fluctuations of the blood pressure from 126/88 under sedation to 204/146 with the extremities in cold water, and the patient receiving ergotamine.

Roentgen studies of the abdomen showed a mass 6.5 by 5 cm. containing calcium flecks between the transverse processes of the second and third lumbar vertebrae on the left side. An intravenous urogram showed lateral displacement of the left ureter. At operation the mass was removed and the patient went into immediate shock for thirty-six hours. This was treated by adrenalin, adrenal cortical extract and blood and normal salt solution by vein. The pathological diagnosis on the operative specimen was paraganglioma (pleochromocytoma).

The pleochromocytoma is a tumor arising from chromaffin cells in the medullary portion of the adrenal gland. Similar tumors may arise in the dorsal vertebral ganglia, the carotid bodies and the gonads. The chromaffin cells elaborate epinephrine which is a vasoconstrictor and may, in abnormal amounts, induce paroxysmal hypertension. Tumors of these cells occur only in adults and are usually benign.

Compression of the tumor by physical exercise or surgical massage causes a sharp rise in blood pressure, as well as headache, dizziness, weakness, and palpitation. Eventually shock may result. These symptoms, the pres-

ence of pressor substances in the blood, glycosuria and roentgenography, including intravenous urography and perirenal air insufflation, are all diagnostic aids.

Roentgenograms may show a mass in the adrenal area with or without calcification. Intravenous pyelography may show renal or ureteral displacement. Perirenal air insufflation may show tumors not otherwise detectable.

The treatment is surgical.—*Rolfe M. Harvey, M.D.*

SKELETAL SYSTEM

Ellis, V. H. Squamous-cell carcinoma of the nail bed. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 656–658.

Squamous cell epithelioma of the nail bed or sulcus is a well known but uncommon type of neoplasm. It is often mistaken for chronic paronychia. The insidious progress of the tumor and the frequency with which it is wrongly diagnosed make it of interest and importance. Ellis states it must be distinguished from malignant melanoma of the nail. Both are found more often in the fingers than the toes, and the thumb is the digit most often affected, the right more so than the left. There is often a history of trauma or infection which proved resistant to treatment. Metastases in the phalanges of the hand from bronchial carcinoma must also be considered in the differential diagnosis.

Three cases are reported, 2 in the thumb and 1 in the terminal phalanx of the right middle finger.—*R. S. Bromer, M.D.*

Edmonds, H. W., Coe, H. E., and Tabrah, F. L. Bone formation in skin and muscle; a localized tissue malformation or heterotopia. *J. Pediat.*, Nov., 1948, *33*, 618–623.

The authors report the fourth case of bone formation within skin, subcutaneous tissue, and muscle occurring in a child. The child was born prematurely and weighed 3 lb. 15 oz. at birth. At the age of one month a small hard area was noted in one breast. The child was exposed to the sun and it was noted that greater reddening of the radial side of the left arm occurred than in the rest of the skin. Numerous enlargements of the left upper extremity became apparent during the next few months and this was followed by spontaneous extrusion of calcareous material. Laboratory studies were essentially negative. Roentgenograms showed extensive soft tissue calcification of the left upper extremity. Numerous masses were dissected out and histopathologic examination of these masses showed the presence of mature bone.

The authors summarize the previously reported cases occurring in children of abnormal bone formation in the skin, subcutaneous tissues, and muscles. The lesions did not recur following removal. The authors feel that this is a case of heterotopic bone formation, formation of normal tissue at an abnormal site. Other conditions to be differentiated are localized and disseminated calcinosis, traumatic ossifying myositis, progressive ossifying myositis and metastatic calcification with hyperparathyroidism.—*Rolfe M. Harvey, M.D.*

Brailsford, James F. Ossifying hematomata and other simple lesions mistaken for sarcomata; the responsibility of biopsy. *Brit. J. Radiol.*, April, 1948, *21*, 157–170.

James Ewing stated, "The whole clinical and radiological picture of the case of bone sarcoma usually furnishes a better conception of the diagnostic and therapeutic problem than can be obtained from a biopsy." A biopsy is necessarily only a minute fragment and cannot show the entire picture. Proliferating cells in dysplasias, response to trauma, infection, endocrine or vitamin deficiency, and neoplasia can be interpreted by various observers as representing all phases between simplicity and rapid malignancy. Biopsy may lead to an unnecessary amputation or it may be the cause of serious delay.

The essential information regarding any tumor is whether it is benign or malignant. At times the clinical and roentgenological features are indefinite, but Brailsford has found that in this type of case the histopathological features have been equally indecisive. The most valuable evidence is a combination of clinical and roentgenological observation, prolonged over a period depending on the rapidity of the change.

Several cases are presented to illustrate these statements. Ossifying hematomas and certain sarcomas may both show massive dense calcification in a patient with a palpable mass, and possibly no history of trauma. One such patient had four operations in a six month period. Biopsies at the time of the first two operations were reported as showing benign chondroma, at the third a chondrosarcoma was diagnosed, and finally the limb was disarticulated. The author, who had seen the films only in consultation, had reported a chondrosarcoma before the first biopsy.

Ossifying hematoma occurs in osteogenesis imperfecta and the mass is easily palpable, covered by stretched skin, with possible venous distention, and even edema. Eventually these masses are incorporated into the shaft of the bone which is then widened, irregular, and has coarse trabeculations.

A patient, aged three months, presented a non-tender, hard, fusiform swelling of the femur which after roentgen and clinical examinations was thought to represent an osteogenic sarcoma. The author was asked for an opinion and he stated that the lesion was an ossifying hematoma. On vitamin C therapy the hematoma was gradually absorbed.

Large hematomas may develop in sites of injury when the nerve supply is damaged. Injury sustained during periods of excitement may lead to hematomas when the patient has no memory of the trauma. Massive callus around a "march fracture," or calcification in hemorrhage due to hemophilia, also occurs. All of these have at times been mistaken for sarcoma. Unusual calcification occurs in the medulla of long bones, and usually represents an infarct. These are clinically insignificant, but even these have been investigated by biopsy by inexperienced observers and this has resulted on occasion in amputation. Septic foci, as osteoid osteoma, have been confused with sarcoma, as has melorheostosis.—*E. F. Lang, M.D.*

Ponseti, Ignacio. Bone lesions in eosinophilic granuloma, Hand-Schüller-Christian disease and Letterer-Siwe disease. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 811–833.

Eight cases were selected to illustrate in this paper the clinical, roentgenographic, and histopathologic characteristics of bone lesions occurring in eosinophilic granuloma, Hand-Schüller-Christian disease and Letterer-Siwe disease. Although the cause of these diseases is still very obscure, studies made during the past decade have established that they probably represent forms of the same pathological process. This series of cases is presented by Ponseti mainly to cooroborate this modern trend of thought.

The solitary eosinophilic granuloma of bone is the mildest form of this group of diseases. The local symptoms are tumor, tenderness and very slight pain. The roentgenograms show a more or less clear-cut defect, well outlined by normal appearing bone. There may be reactive periosteal new-bone formation. A case of a solitary lesion has a good prognosis, and the lesion does not recur after its surgical removal or after roentgen therapy. However, malignant forms may occur which are resistant to treatment and which may recur, producing great bone destruction. Even in these instances, the general outlook for the patient is good. Patients with multiple eosinophilic granuloma may or may not show signs of general illness.

Two cases are cited to show that intermediary forms between multiple eosinophilic granuloma and Hand-Schüller-Christian disease exist. Likewise, two others are cited which were considered to be transitional forms between Hand-Schüller-Christian disease and Letterer-Siwe disease. The solitary eosinophilic granuloma of bone and the uncomplicated multiple eosinophilic granuloma form a distinct clinical group. However, from a clinical point of view, it would be convenient to group cases of multiple eosinophilic granulomas of bone, with involvement of other organs, under a common heading with Hand-Schüller-Christian disease and Letterer-Siwe disease. The age of patients in this group varies, although it is often during early childhood that symptoms appear, usually in an insidious manner.

A peculiar inflammation of the gingivae, with hypertrophy and, occasionally, ulceration of the gums, is frequently seen as an early symptom. The roentgenograms of the maxilla showed small cystic areas of bone destruction adjacent to the alveoli in 3 of the cases of the series. More or less extensive infiltration in both lung fields is often seen on roentgenographic examination.

Bone lesions were very frequent. The skull was involved in all of the patients but one, where the lesions were limited to the extremities. Any bone may be affected, even the metacarpals and phalanges. The roentgenographic appearance of the bone lesions in Hand-Schüller-Christian and in Letterer-Siwe diseases was usually identical to that seen in lesions of solitary and multiple eosinophilic granulomas. The areas of bone destruction were frequently sharply outlined and the surrounding bone appeared normal. In one patient, very destructive lesions were seen with destruction of the cortex and abundant reactive periosteal new-bone formation.

All of the bone lesions explored were found to be filled with granulomatous tissue, made up of a great number of large, mononuclear cells, probably histiocytes, and a small number of leukocytes. Except in the typical eosinophilic

granuloma, eosinophils were not present and the cytoplasm of the histiocytes appeared to be finely or coarsely vacuolated. In other cases, the granulomatous tissue was made up of extensive foam cells. Intermediary stages between these different types of granulomatous tissue were seen in one lesion of one of the cases. The structures surrounding the areas of bone destruction were in no instance infiltrated by the granulomatous tissue, even in the most malignant appearing lesion.

Roentgen therapy was given to the bone lesions in all of the patients. The pain was relieved in each case a few days after treatment; however, it was difficult to evaluate the effect of the roentgen treatments on the development and final outcome of the bone lesions and on the disease as a whole. In one case, where one of the bone lesions and a group of lymph nodes were not treated, the pain persisted in the untreated lesion, but rapidly disappeared in the treated areas; yet the bone lesions filled in with normal appearing bone at the same rate, regardless of whether or not they had been treated. Likewise, the treated and untreated cervical lymph nodes regressed at the same rate. In another case, the infiltration of the lung disappeared without treatment. In another instance, the infiltration disappeared one year after roentgen therapy; yet in another, there was no change in the pulmonary infiltration despite the irradiation. Notwithstanding these experiences, the author believes that roentgen therapy usually has a favorable influence upon the granulomatous lesions in eosinophilic granuloma, Hand-Schüller-Christian disease and Letterer-Siwe disease, and that it should always be given to these patients until the etiology of these diseases has been discovered.—*R.S. Bromer, M.D.*

Wilson, John C., Jr. Streptomycin in the treatment of chronic infections of bone. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 931–944.

In this paper, the author presents 25 cases of chronic osteomyelitis in which discharging sinuses had been present for an average of nineteen months. Many types of treatment had been tried, without success. In an effort to promote healing, the following plan of therapy was tried:

1. Thorough investigation of the wound bacteria;
2. Radical sequestrectomy after adequate preoperative preparation;
3. The use of streptomycin and penicillin before, during, and after surgery;
4. Meticulous wound care after surgery to prevent contamination.

Twenty-one patients responded very favorably to this plan of treatment and their wounds healed. Four patients failed to respond and all had amputations. Wilson emphasizes very strongly that the use of streptomycin offers no panacea for the treatment of chronic osteomyelitis. The drug is not a replacement for adequate surgery; but when combined with through sequestrectomy, it is beneficial in the promotion of healing. No claim, also, is made that the course of the disease has been altered permanently or that a cure has been obtained in any case. The salutory response of the patients which allowed their prompt return to a healthy, useful life, persuaded the author to present this study as a preliminary report.—*R. S. Bromer, M.D.*

Warrick, C. K. Posterior dislocation of the shoulder joint. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 651–655.

Posterior dislocation of the shoulder is an unusual injury and there is often much delay before the diagnosis is made. This is partly explained by the rarity of the injury which, being unsuspected, is not recognized when physical signs are masked by swelling. If the condition is borne in mind when the patient is examined and the roentgenograms are studied, the diagnosis should not be missed. A single anteroposterior view of the shoulder joint is inadequate. A pair of stereoscopic films is desirable, but for routine emergency work other projections are necessary. A vertical view should be secured, either with the limb abducted and the tube directed toward the axilla, or with the tube above the shoulder and a curved cassette in the axilla. When this is impossible a profile or posterior view of the scapula may be substituted.—*R. S. Bromer, M.D.*

Khoo, F. Y., and Kuo, C. L. An unusual anomaly of the inferior portion of the scapula. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 1010–1011.

A case of unusual anomaly of the inferior portion of the scapula is reported. The patient was a Chinese male, aged forty-two. During a fluoroscopic examination of the chest, an unusual notching of the inferior portion of the right scapula was noted; the left scapula appeared to be normal. A roentgenogram of the

right scapula showed that it was shorter than normal, owing to the absence of its lower fourth. The inferior aspect, instead of being pointed, ended in two processes, one on each side with a deep semi-elliptical notch between them. The lateral process was somewhat lower and narrower than the medial process, and had two larger projections or spines. The medial process was somewhat blunt. The axillary border of the scapula was slightly wavy in outline and was mildly concave. The vertebral border was fairly straight, except for a slight inclination lateralward above the spine of the scapula.

The authors quote Hrdlička's study of the human scapula. They feel that the scapula found in their patient can reasonably be considered as showing a developmental anomaly rather than just a developmental variation.—*R. S. Bromer, M.D.*

Vitt, Robert J. Dislocation of the head of the fibula. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 1012–1013.

Dislocation of the head of the fibula is a rare injury, usually associated with a fracture at a lower level of the tibia. The author reports 4 cases in which the dislocations resulted from parachute-landing falls. The patients were males ranging from eighteen to twenty years of age. All the dislocations were anterior and were associated with inversion ankle sprains of varying degree. Roentgenograms showed forward and slight lateral displacement of the head of the fibula. There were no signs of tear of the cruciate ligament or collateral ligament. Roentgenograms of the tibial and fibular shafts and the ankles revealed no fracture in any of the patients.

In assuming the "parachute-landing position," paratroopers are taught to flex their legs and keep their feet together. In this manner, the fibular collateral ligament and the biceps femoris are in a relaxed state. As sharp inversion of the ankle causes tension of the peroneal muscles, and a lateral twisting motion of the trunk is transmitted to the tibia, the fibula is free to dislocate anteriorly. The author assumes that this is the mechanism of the dislocation.—*R. S. Bromer, M.D.*

Fairbank, T. J. Knee joint changes after meniscectomy. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 664–670.

This paper is the record of an investigation of changes found in the knee joint at intervals ranging from three months to fourteen years after meniscectomy. Fairbank in searching the literature could find only one reference to these changes. Of the roentgenograms shown, one depicts the formation of a ridge from the margin of the femoral condyle in a patient aged forty years, six years after removal of the medial meniscus. In another patient, aged thirty-six, flattening of the femoral condyle was shown seven years after removal of the medial meniscus. In a patient, aged twenty-five, narrowing of the joint space laterally and widening medially was demonstrated five months after removal of the lateral meniscus.

Fairbank concludes that changes in the knee joint after meniscectomy include ridge formation, narrowing of the joint space, and flattening of the femoral condyle. His investigations suggest that these changes are due to loss of the weight-bearing function of the meniscus. Meniscectomy is not wholly innocuous as it interferes, at least temporarily, with the mechanics of the joint. He thinks it is likely that narrowing of the joint will predispose to early degenerative changes, but a connection between these appearances and later osteoarthritis is not yet established and is too indefinite to justify clinical deductions.—*R. S. Bromer, M.D.*

Leveuf, Jacques. Results of open reduction of "true" congenital luxation of the hip. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 875–882.

This paper, the author states, deals only with "true" congenital luxations of the hip. It deals with advances since he published with Bertrand a book on this subject. In luxation one always finds an interposition of soft tissues between the head of the femur and the acetabulum. A narrow hourglass constriction of the capsule is present, confining the head. The acetabulum is obstructed by the inferior fold of the capsule. A cartilaginous roof (or limbus) is pushed down into the joint by the head and a huge ligamentum teres is present in half of the cases. The head is round in shape and is of small size. After the interpositions have been removed, the acetabulum itself appears to be of fair size and depth.

In subluxation, interposition of soft tissues never exists. The most important lesion is the limbus which is pushed against the iliac bone. Atrophy of the roof causes the acetabulum to assume an oval shape. The head of the femur is bulky and out of shape so it is difficult to get

good congruence of the joint after reduction.

All of these anatomical facts, the author claims, can be easily shown by arthrography. At the same time it can be seen whether or not closed reduction is perfect. His experience indicates that in true luxation, clearly established by arthrography, the interposition of soft tissues makes a correct reduction of the displacement impossible without open operation.

This study is based on a total of 318 hips operated upon between 1941 and 1947. There were 119 primary open reductions, 96 open reductions with shortening of the femur, and 103 secondary open reductions for reluxation after closed treatment. There were 5 deaths in the series, a fatality rate of 1.57 per cent. The results are given in detail. Leveuf states that it would be certainly better to avoid reluxations and secondary subluxations. That is why it is necessary to check the reduction, by means of arthrography, in all cases of congenital dislocation of the hip. Then one can verify that it is impossible to obtain a good result in true luxation without primary open reduction.

The article is well illustrated with roentgenograms showing the findings in the dislocated hips after injection of the opaque material, and also the results of operative procedures. His previous article describing the arthrographic procedure in more detail was abstracted in this Journal, March, 1948, vol. 59, p. 465.—*R. S. Bromer, M.D.*

Le Mesurier, A. B. Developmental coxa vara. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 595–605.

Despite the fairly extensive literature, and probably because the condition is not common, the real nature and severity of developmental coxa vara have seldom been recognized as soon as they should be, and treatment has not usually been started until there was marked deformity. The condition is characterized by the development, at the age of three or four years, of a limp or waddle which is usually painless and is progressive. A varying degree of coxa vara is present on one or both sides, but the striking feature is the roentgenographic appearance of a gap in the neck of the femur just distal to the epiphyseal line, together with a bend in the femoral neck at this level. This roentgen appearance is, in itself, almost sufficient to establish the diagnosis as soon as the patient is first seen.

The condition is rare and few large series of cases have been reported. In the series reported in this paper, there were 15 cases. The roentgenographic appearances were very similar in nearly all cases. Even in early stages, when the child first began to limp, a gap in the bone was already obvious. It crossed the neck of the femur distal to the diaphyseo-epiphyseal junction. In most cases it ran part of its course parallel to the epiphyseal line, but towards one end, usually the lower, it branched away from it, and in some cases also usually at the lower end, it divided into two, leaving a triangular portion of bone more or less isolated. The gap was not broad and it did not follow a straight line with clear-cut edges; the margins were usually uneven. The bone was abnormal in appearance, particularly just distal to the gap; irregular areas of greater density alternated with areas of lesser density, giving rise to the appearance often described as "fragmentation." In no case was there increased density of the femoral head suggesting necrosis of the bone such as may occur in slipped epiphysis or in fractures at this level. The density of the head was often less than normal. The epiphyseal line was usually narrow, and sometimes it could only be seen with difficulty. The gap in the bone in this condition is not just at the diaphyseo-epiphyseal junction as in slipping of the upper femoral epiphysis.

In some early cases of coxa vara in which the deformity was not marked, the gap in the bone ran in a direction more horizontal than vertical. As deformity increased the head rotated downwards and both the gap, and what could be seen of the epiphyseal line, became more vertical.

No tissue was removed for pathological examination, so no information is added to the origin or cause of the condition.

In the treatment of developmental coxa vara, the coxa vara deformity and the gap in the femoral neck must both be taken into consideration. Traction is not satisfactory. It seems unwise, also, to complete division of the neck at the gap by operation, or to do an osteotomy through the neck distal to the gap. Unless the deformity is very severe indeed, limitation of abduction can be overcome and shortening can be reduced by the safer procedure of osteotomy between the trochanters, or below them, the lower fragment being abducted widely. Abduction osteotomy is a satisfactory method of treatment in cases in which the coxa vara deformity is bad enough to require correction. It

leaves a hip joint which may not be perfect in function, but which is much better than it was, and which is unlikely to get any worse for the reason that the gap in the neck becomes closed. In early cases the most important thing is to close the gap before deformity becomes disabling, and it would seem better, if possible, to do this without osteotomy which may distort the mechanism of the hip. Since healing of the gap after osteotomy seemed to be due to elimination of the shearing forces, it was thought that the same result could be obtained by insertion of a Smith-Petersen nail. In addition, grafting was attempted; two tibial grafts, placed cortex to cortex, were placed in a drill-hole in the femoral head which was drilled through the neck into the head. It would seem that this is much the best way to secure closure of the gap. The objection that at this age a bone graft across the epiphyseal line may arrest growth applies very little in these cases, because in any event growth in length here will be almost negligible.—*R. S. Bromer, M.D.*

Viterbo, Francesco. Contributo radiologico alla conoscenza delle cisti da echinococco vertebrale. (Roentgenological contribution to the study of vertebral echinococcus cysts.) *Radiol. med.*, Feb., 1948, *34*, 75–83.

The author presents a case of a female patient, aged 32, who was hospitalized one month after the onset of the disease characterized by pain of increasing severity in the right iliac fossa radiating to the right lower extremity and aggravated by physical activity.

A roentgen examination showed a large osteolytic bone defect of the right half of the body of the first lumbar vertebra with no evidence of compression, no wedging, no gibbus and with normal disc spaces.

The patient was immobilized in a plaster of paris jacket and was given roentgen therapy. At the completion of treatment a second roentgenographic examination showed partial repair in the right half of the body of the vertebra where there was evidence of sclerosis and calcification in a network which continued into a mass the size of an orange. This mass extended downward into the paravertebral region to the level of the lower border of the second lumbar vertebra. Its margin was calcified and it contained numerous lacunae which were outlined by a similar network of calcification and sclerosis.

The author considers in some detail the differential diagnosis of the following bone diseases: tuberculosis, tumors, solitary cyst, parasitic cysts.

Although localized cystic tuberculosis may be difficult to exclude in certain cases, in this case the massive involvement without extension to the intervertebral disc is not in favor of a diagnosis of bone tuberculosis.

Giant cell tumor is usually limited to the bone involved and is of slow growth. The possibility of hemorrhage with subsequent reparative changes may make its exclusion as a diagnosis difficult in this case.

Bone localization of the *Taenia echinococcus* occurs in 2 per cent of cases. Probably because of its rich blood supply the vertebral column is the commonest site and represents about 40 per cent of cases.

The roentgen findings in this case are typical of the unilocular hydatid cyst in a vertebral body.

The response following radiation therapy with bone repair, calcification and sclerosis of the cyst and with return to a nearly normal function of the spine may have been a fortuitous coincidence. It is difficult to understand what mechanism was involved in this response, since to date roentgen therapy has not been considered effective in the treatment of hydatid cysts.—*Anthony A. Blasi, M.D.*

Lischi, Giancarlo. Due casi di vertebra eburnea apparentemente primitiva. (Two cases of primary sclerosis of a solitary vertebra.) *Radiol. med.*, July, 1948, *34*, 385–399.

The author reviews the classification of sclerosis of a solitary vertebra. He classifies these lesions as (1) neoplastic diseases, either primary or metastatic; (2) sclerosis, secondary to systemic or local disease; (3) unknown etiology. Under neoplastic primary disease he mentions osteoblastic varieties of primary bone sarcoma. Under metastases he lists order of frequency as carcinoma of prostate, breast, especially the scirrhous type, stomach, colon, and hypernephroma. Under systemic diseases he lists various type lymphomas, Paget's disease, syphilis, tuberculous spondylitis, staphylococcus, and/or streptococcus spondylitis, post traumatic collapse of a vertebra (Kümmell's disease) and myelosclerosis. Under unknown etiology he makes the point that diagnosis is only possible by exclusion and prolonged follow-up studies. He reports 2 asymptomatic cases evidently belonging to the latter group,

each of which had been followed for many years without known pathology.—*C. A. Privitieri, M.D.*

Roche, Maurice B. Bilateral fracture of the pars interarticularis of a lumbar neural arch. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 1005–1008.

A case of bilateral fracture of the pars interarticularis of a lumbar neural arch is reported. The patient, a male, twenty-two years of age, sustained multiple injuries when a jeep, in which he was riding, overturned. In addition to other injuries, roentgenograms showed bilateral fractures involving the isthmuses on both sides of the neural arch of the third lumbar vertebra. These were demonstrated in anteroposterior, lateral, right and left postero-oblique views.

The genesis of a defect or solution of continuity in the interarticular portion of the neural arch of a vertebra, known as "spondyloschisis" has been considered by some writers as congenital, by others as due to trauma. Very little mention is made in the literature or in textbooks on fractures of this seemingly unique lesion, namely, acute traumatic spondyloschisis unaccompanied by spondylolisthesis. It is thus true, as shown by the case reported, that an intact portion of the spinal column, free from congenital defect, is also susceptible to acute traumatic spondyloschisis.

Later roentgenograms approximately four months after the accident showed healing of the fractures.—*R. S. Bromer, M.D.*

Caldwell, Guy, A., and Sheppard, William B. Criteria for spine fusion following removal of protruded nucleus pulposus. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 971–980.

The authors studied 75 patients in whom protrusion of the nucleus pulposus was proved at operation and who returned for roentgenographic and clinical re-examination. Cases were eliminated from the study as follows: (1) those upon whom spine fusions were done at the time of the original operation; (2) those in whom no definite pathological conditions could be found to account for symptoms; (3) those in whom other pathological conditions could be demonstrated to explain the symptoms.

Their study suggests the following: Excellent results can be obtained in as high a percentage of cases by laminectomy alone as by the combined operation. Hypertrophic changes of variable degree, with or without narrowing of the disc, occurred in 69.3 per cent of the cases studied. Functional end results did not correlate with or depend upon the presence or extent of such postoperative changes. The end results were not significantly related to the existence of anomalies. Recurrences took place in 8 per cent of the cases studied, but did not seem to relate to the presence of anomalies or postoperative narrowing of the disc and hypertrophic changes. The number of recurrences was small, and there was nothing in the preoperative history and findings which indicated that protrusion would occur again at the same or another level. Most of the unsatisfactory results (other than recurrence of protruded disc) were such that spine fusion would not have improved them.

The authors therefore conclude that there are no criteria for spine fusion following removal of a protruded nucleus.—*R. S. Bromer, M.D.*

du Toit, J. G., and Fainsinger, M. H. Spinal extradural cysts. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 613–618.

In this paper, two types of spinal extradural cysts are discussed: (1) the type which occurs in adolescents in the dorsal spine with evidence of kyphosis juvenilis; (2) the type which occurs in adults in the dorsolumbar spine without kyphosis. A case of dorsolumbar spinal dural cyst is reported, the patient having no deformity. Roentgen examination of the middle and upper dorsal vertebrae showed no abnormality. The lower and upper lumbar vertebrae showed definite changes. In the lateral film the vertical interpeduncular spaces were increased and the anteroposterior view showed flattening and atrophy of the medial aspects of the pedicles. The interpeduncular distances showed irregular variation in place of the normal regular increase in the caudal direction. The tenth and eleventh dorsal and the first and second lumbar vertebrae showed abnormal measurements. In the lateral projection there was marked hollowing of the posterior surfaces of the bodies, particularly from the tenth dorsal to the third lumbar vertebrae. Narrowing of the pedicles in the vertical diameter, with consequent enlargement of the intervertebral foramina, was also evidence in this view. These findings were interpreted as indicating the presence of a large mass within the spinal canal, extending from the tenth dorsal to the third lumbar vertebrae and causing pressure changes in adjacent bone. Myelography showed enlargement of the neural canal. The opaque medium passed beyond the

normal confines of the spinal theca and through the intervertebral foramina. The passage of globules of lipiodol beyond the lateral limits of the neural canal suggested recesses, or diverticula, communicating by means of a narrow neck with the sub-arachnoid space.

Laminectomy showed three large cysts, each containing clear colorless fluid. They were thin walled and, except at the exit of two nerve roots where the cysts were closely adherent, could easily be dissected off the dura. The spinal canal was found to be much widened. After operation, the spasticity of the right lower limb which the patient had, disappeared rapidly and that of the left lower limb more slowly. When last seen she was walking well without assistance, and although there was some valgus deformity of the left foot, she considered that her recovery was complete.

The origin of spinal extradural cysts has not been established finally. This case, the authors think, supports the hypothesis that the extradural cyst is due to a congenital diverticulum of dura mater or to a herniation of the arachnoid through a congenital defect in the dura. It would seem that there is a tendency for the lumbar extradural cysts to become manifest at a later age than dorsal cysts. A likely explanation is that the lumbar canal is spacious and the cauda equina is readily displaced, so that cysts may grow without giving rise to symptoms for a longer period in the lumbar spine than is possible in the dorsal region.

It has been suggested that kyphosis dorsalis juvenilis may be the result of venous congestion and stasis in these vertebral bodies, whatever the cause of the vascular disturbance. This suggestion is not supported by the fact that there was no vertebral deformity in the 4 previously reported cases of lumbar cysts.—*R. S. Bromer, M.D.*

Zadek, Isadore, and Gold, Aaron M. The accessory tarsal scaphoid. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 957–968.

In this article, the authors use the term "accessory tarsal scaphoid" (navicular) to indicate that accessory element which is juxtaposed medially and posteriorly to the tubercle of the tarsal scaphoid. It often gives the appearance of an extension of the scaphoid bone rather than resembling the other accessory scaphoid elements of rare occurrence, such as the os supranaviculare, the os infranaviculare or the true bipartite scaphoid.

The authors were fortunate to find children and adolescents whose roentgenograms showed accessory scaphoids; these patients were reexamined, both clinically and roentgenographically, at intervals of one to eight years after the original roentgen examinations. Eight such cases, representing fourteen accessory scaphoids were studied with follow-up examinations.

The roentgenograms of the fourteen accessory scaphoids showed that definite fusion between the accessory scaphoid and the scaphoid bone occurred in five instances, partial fusion occurred in three and there was failure of fusion in six.

Microscopic studies of the accessory bones removed showed that the accessory scaphoid and the scaphoid bone, having the usual cancellous trabecular structure of tarsal bones, were joined by a layer of soft tissue. This soft tissue plate consisted of hyaline cartilage, dense fibrocartilage, or a mixture of the two. The plate varied in thickness, was occasionally beset with longitudinal or transverse clefts, and frequently showed very active ossification on each side. In none of the cases studied was a well developed, freely movable joint found, with smooth hyaline articular cartilage capping each bone, and with the two articulating bones found together by a synovial-lined fibrous capsule such as one would expect to find in the talonavicular joint. The specimens frequently exhibited evidences of trauma in the form of hemorrhages, organizing fibrous tissue containing giant cell osteoclasts and chondroclasts and callus-like reparative tissue located subchondrally. The authors think this explains the acute symptoms and localized pain often found in patients with an accessory scaphoid.—*R. S. Bromer, M.D.*

Harris, R. I., and Beath, Thomas. The etiology of peroneal spastic flat foot. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 624–634.

The authors state that peroneal spastic flat foot is a term loosely and often inaccurately used to describe rigid valgus feet developing from widely different causes. The most common causes are two anomalies of the bones of the tarsus, the calcaneonavicular bar, and the talocalcaneal bridge. The first has been described. The second is described for the first time in this paper as an etiological factor in rigid flat foot though it has been recognized by anatomists for fifty years as a skeletal variation. The term peroneal flat foot, as applied in these cases, is

inaccurate since there is no spasm of the peroneal muscles. The deformity is a fixed structural deformity due to anomalous bone structure, and the apparent spasm of peroneal muscles is in reality an adaptive shortening. A better term would be rigid flat foot due to talocalcaneal bridge or calcaneonavicular bar. Roentgenograms demonstrating these variations are included in the paper.

The smaller group of patients who suffer from inflammatory lesions of the tarsal joints, chiefly due to rheumatoid arthritis, do in fact develop valgus deformity from peroneal spasm. The resemblance between the two groups is superficial and it is limited to the apparent similarity of the deformity. Though it might be justifiable to designate this type as peroneal flat foot, the authors think it would be better to use the more accurate title—arthritic flat foot with peroneal spasm.

Lipping of the upper margin of the talonavicular joint strongly suggests the existence of one or other of the congenital anomalies. Both anomalies are visualized only by special roentgenographic projections, lateral and posterosuperior oblique views.—*R. S. Bromer, M.D.*

Fairbank, H. A. Thomas. Dyschondroplasia. Synonyms—Ollier's disease, multiple enchondromata. *J. Bone & Joint Surg.*, Nov., 1948, *30-B*, 689–708.

This paper is part of an Atlas of General Affections of the Skeleton. In it the hereditary and familial influences, sex and age incidence, etiology, distribution, clinical signs, roentgenographic appearances, progress and complications, pathology, and diagnosis of dyschondroplasia are discussed. The roentgenograms which are reproduced show the changes of the condition very clearly.

Fairbank states that the condition is often linked with diaphyseal aclasis or multiple cartilaginous exostoses. The two conditions are regarded as variants of the same fundamental developmental error. This, he thinks, may lead to confusion which, however, is quite unnecessary. Although both result from a fault of the epiphyseal line, nests of cartilage becoming misplaced instead of calcified and ossified in the normal manner, they are roentgenologically and in other ways quite different and in the vast majority of cases are readily distinguishable. In the condition to which he prefers to confine the term dyschondroplasia, masses of cartilage are found inside the metaphyses, the lesions being endosteal and not projections on the surface, as are exostoses.

There is a strong tendency towards unilateral distribution of the lesions, though seldom strictly so. Fairbank thinks there seems to be no sufficient reason for linking the condition of striated bones reported by Voorhoeve (1924) with dyschondroplasia and osteopoikilosis, as suggested by that author. He believes the association of enchondromata and exostoses in the same case is very rare, in fact much more rare than some authors would indicate. In younger children, the epiphyses usually show no abnormality, but in older children, even from five years upwards, irregularity in density with mottling and occasionally streaking of some epiphyses may be seen in the roentgenograms. In the adult, abnormal streaking still visible in the shaft of a bone may be seen to extend into what was the epiphysis. As a rule there is little tendency, except in the hand and foot, for the masses of misplaced cartilage to proliferate. In the fingers, the presence of many enchondromata of considerable size, fungating through the cortices, may eventually cause complete crippling of the hand. In a major long bone proliferation of an endosteal nest of cartilage occasionally continues after growth has ceased, but this is very unusual. Even more rare is the development of a chondrosarcoma. It is not always easy to determine whether such a growth has arisen endosteally, or started in the cartilage cap of an exostosis. The latter appears to be distinctly the more common of the two.

The diagnosis is usually easy when roentgenographic surveys of the skeleton have been made. Films of the digits are particularly helpful in doubtful cases. Maffucci's syndrome is a condition in which dyschondroplasia is associated with cavernous hemangiomata and phleboliths in soft tissues. Very few cases of this syndrome have been reported. Carleton in 1942 reported 2 cases and found only 20 others in the literature.

Included in this article is a discussion of metaphyseal dysostosis. This is an excessively rare condition in which the metaphyses of all long bones consist for the most part of unossified cartilage. The roentgenographic appearances are unique and they differ considerably from those seen in dyschondroplasia. Changes in the hands differ strikingly from those of dyschondroplasia; the cartilage masses, dotted with fragments of bone, are seen only adjacent to every epiphysis and they are not distributed

irregularly as isolated enchondromata anywhere in the shafts of the metacarpals and phalanges. The carpus of the only case which could be found reported in the literature seemed to be ossified normally, likewise much of the tarsus, but the posterior portion of the os calcis showed changes similar to those in a metaphysis. In the metaphyses of the long bones there were spots of calcification and ossification varying in size, shape and density. Many of them seemed to be enlarged. There were wide intervals between the shafts and the epiphyses, the spaces containing varying numbers of rather dense and discrete centers of ossification. The epiphyses were not mottled. The skull, spine, ribs, and clavicles appeared to be ossified in normal fashion.—*R. S. Bromer, M.D.*

Sherman, Mary S. Estrogens and bone formation in the human female. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 915–930.

In a woman of fifty-eight years, many of whose bones had almost disappeared as a result of Paget's disease, together with a severe postmenopausal osteoporosis, massive estrogen therapy was followed almost at once by a remission of clinical symptoms and by actual reconstitution of bone.

Albright and his associates studied postmenopausal osteoporosis as a hormonal deficiency and found that they could produce and maintain calcium retention in the human being by the injection of estrogens. These metabolic effects were accompanied by a satisfactory improvement in symptoms. The interpretation offered by Albright is that osteoporosis is a disorder in which the etiological factor is a hypofunction of the osteoblasts in producing bone matrix. In some fashion, not yet clearly understood, estrogens are assumed to stimulate the osteoblasts, so that the process of ossification can proceed normally. Albright and his coworkers admitted, however, that irrefutable evidence that the bones actually became denser has never been obtained by them or by others. In the case reported by the author in this paper, actual reconstitution of bone occurred.

Withdrawal of the estrogen produced an exacerbation of the condition; its readministration was again followed by improvement. For over two years the patient has been kept on daily doses of from 2,000 to 10,000 rat units (0.33 to 1.66 milligrams) of estradiol benzoate. During this time she has maintained her improvement and has showed no untoward symptoms. There was no evidence, either clinical or roentgenographic, of a tendency of the bone to absorb except when estrogen was discontinued.

Paget's disease of bone is accompanied by an increased circulation. Thus it is conceivable that the ordinary process of postmenopausal atrophy, when it evolves in a bone which is already the site of an active Paget's disease, is greatly augmented both in rapidity and in degree.—*R. S. Bromer, M.D.*

Vandemark, Walter E., and Page, Manley A. Massive hyperplasia of bone following fractures of osteogenesis imperfecta. *J. Bone & Joint Surg.*, Oct., 1948, *30-A*, 1015–1017.

Two cases of osteogenesis imperfecta are reported in which an osseous mass developed at the fracture site, expanding in all directions. This was accompanied by local heat, redness, pain and tenderness, and, in the one case seen in the acute stage, by systemic fever. In both cases, the question of malignancy was raised by consulting orthopedic surgeons. In the first case a biopsy was performed, five months after the fracture of the humerus had occurred. Both patients had definite osteogenesis imperfecta.

The exact nature of the process is obscure at present. It would appear to indicate a quantitatively exaggerated repair reaction of osteoblasts whose qualitative defect characterizes this bone dysplasia.—*R. S. Bromer, M.D.*

GENERAL

Archer, Vincent W., Cooper, George, Jr., and Adair, Norman. Symptoms masked or modified by chemotherapy. *J.A.M.A.*, Oct. 30, 1948, *138*, 645–650.

During the past few years members of the Department of Roentgenology of the University of Virginia Hospital have been impressed by the increasing number of patients with diagnostic difficulties following chemotherapy in whom the symptoms did not fit in with the roentgen findings. The authors found this to be particularly true in surgical complications such as abscess of the lung and infected bronchiectasis resulting from pneumonia.

Fourteen illustrative cases of varied conditions are presented, with symptoms and signs at variance with the roentgenologic and operative findings. The type of cases in which symptoms were markedly altered by chemotherapy include the following conditions: (1) diverticulitis with cancer, (2) fibrosarcoma, (3) peri-

nephritic abscess, (4) lung abscess, (5) acute cholecystitis, (6) mastoiditis, (7) subphrenic and subhepatic abscess, (8) empyema and (9) osteomyelitis.

In conclusion, the authors state that "the roentgenologist must accept an increasingly large share of the responsibility for correct evaluation of progression or regression of pathologic processes due to infection when treated by chemotherapy."—*R. F. Niehaus, M.D.*

Peskin, A. Robert. Increased sugar tolerance as a factor in the production of a symptom complex simulating peptic ulcer, neurocirculatory asthenia and psychoneurosis. *Am. J. Digest. Dis.*, March, 1948, *15*, 92–101.

Four cases are presented in which vague symptoms of a bizarre character were experienced for four years. In some, there was a family history of similar complaints. These symptoms were: hunger pains relieved by food, nervousness, apprehension, weakness in the legs, tremors, excessive perspiration, and mental dullness. The symptoms were aggravated or precipitated by physical effort and were prevented or relieved by eating and rest. The similarity of the group of symptoms to symptoms associated with peptic ulcer, neurocirculatory asthenia, or psychoneurosis is discussed. The disclosure of the true cause for these symptoms, by a study of the sugar tolerance, suggested itself from the similarity of these symptoms to those of hypoglycemia. Study of the blood sugar level at which symptoms of mild hypoglycemia occurred revealed that these patients displayed symptoms at a relatively high sugar level. Confirmation of the observation that these patients' symptoms were due to relative hypoglycemia was revealed by reproduction of the same symptoms with insulin and exercise. At a relatively high blood sugar level (88 mg. per cent) one patient began to have symptoms of tremor, air hunger and peculiar discomfort in the pit of his abdomen. More severe symptoms were evident at 74 mg. per cent. A disappearance of symptoms took place with the administration of orange juice. The value of high fat and protein diet in the prevention and relief of this metabolic disturbance is discussed. The practical value of the search for this entity in such obscure cases as neurocirculatory asthenia, psychoneurosis, and peptic ulcer syndrome without positive roentgen findings, is discussed. These patients disclosed mild liver and thyroid dysfunction. The concept that mild symptoms of hypoglycemia may appear at a relatively high sugar level is stressed.—*Franz J. Lust, M.D.*

Brodsky, Edward. Income-sharing formula; basis for paying part time pathologists and radiologists. *Hospitals*, March, 1948, *22*, 35–37.

After a survey of 84 hospitals in the New England area, the author worked out a formula that sets a fair ratio between part time and full time earnings, both in part time and full time arrangements. This article summarizes the more complete edition available in the Bacon Library. Two of the charts suggested as a basis for reimbursement are shown. The original article is worth reading for those interested in a basis for payment equitable to each party.—*George H. Ramsey, M.D.*

ROENTGEN AND RADIUM THERAPY

Trusler, Harold M., and Bauer, Thomas B. Keloids and hypertrophic scars. *Arch. Surg.*, Oct., 1948, *57*, 539–552.

A hypertrophic scar remains confined to area of skin incision or injury but a keloid tends to invade surrounding tissues. Microscopically it is difficult to distinguish them. Trauma to the dermis in susceptible persons is necessary as trauma to the epidermis does not produce keloids. Theories of keloid formation are "hormonal stimulation" and "fibroblastic diasthesis," a fibroblastic response to tissue edema at site of injury. Cutaneous wounds crossing flexion ceases and those that heal under tension are most likely to cause keloids. Regional body susceptibility and racial susceptibility are other factors.

All lesions are kept under observation at least three months or longer after healing. Pressure locally for several months may prevent the two conditions. If hypertrophy occurs roentgen therapy is instituted. If already formed, excision plus radiation are used. Most cases are given radiation (kv., distance, etc. not given) using 1 mm. Al. The first dose is ½ erythema dose. In two weeks this is repeated. Subsequent treatments are at monthly intervals, unless the scar increases in size. The usual number of treatments is four. If lesions are very large, fractional excision plus irradiation is used. The importance of successful skin grafting is emphasized.—*Thomas L. Martin, M.D.*

Kimbrough, Robert A., and Muckle, Craig W. The treatment of carcinoma of the cervix. *Am. J. Obst. & Gynec.*, Oct., 1948, *56*, 687–693.

High voltage roentgen therapy precedes the application of radium in the treatment of carcinoma of the cervix in most clinics today. There are four advantages to this method: The malignant cells are devitalized before local manipulation is carried out; the lymphatics are partially sealed; the local infection is cleared, and there is restoration of the anatomic relationships.

One anterior and one posterior 15 by 15 cm. field port is treated with 2,000 to 2,800 roentgens, in air, at the Pennsylvania Hospital, Philadelphia. Bladder and bowel protection is achieved by placing a lead strip 4 cm. wide and 5 mm. thick in the midline. The depth dose to the midline structures is reduced by 50 per cent beneath the lead strip.

More recently, external irradiation has been supplemented by cervical irradiation through an intravaginal cone.

Six weeks after the completion of the roentgen therapy, radium is introduced into the cervical area, the uterine cavity, and the bases of the broad ligaments. The approximate dose is 6,000 milligram-hours. The patient is kept in the Trendelenburg position in order to protect the intestinal tract during the time the radium is in place.

The authors believe that all patients should be given the maximum amount of radiation therapy, because the end results are nearly equal in highly sensitive, more malignant type and the resistant, more slowly growing type of tumor. The extent of the disease is the only aid in prognosis.

Recently, there has been a return to the Wertheim operation combined with Taussig's lymphadenectomy for the treatment of early selected cases in several of the clinics. Meigs' reasons for advocating this method are as follows:

1. If the cervix is removed, there is no chance for recurrence in it.
2. If the cervix is removed, no cancer can grow in it as a recurrence.
3. Certain cancers of the cervix are radiation-resistant.
4. From the work of Bonney and Taussig it has been proved that about 20 per cent of patients with lymph-gland involvement can be salvaged by surgery.

This method is restricted to good operative risks by those who advocate it. It is not applicable in patients with parametrial invasion. Meigs reported in 1946 that 77.7 per cent of 36 patients so operated on were living more than three years later.

The authors believe that enough time has not elapsed to permit comparison of the surgical and radiation methods of treatment of carcinoma of the cervix.—*Mary Helen Cameron, M.D.*

MacFarland, Catharine, Sturgis, Margaret C., and Fetterman, Faith S. Control of cancer of the uterus. *J.A.M.A.*, Nov. 27, 1948, *138*, 941–943.

Among 1,319 supposedly healthy volunteers for periodic pelvic examination, there were 3 squamous cell cancers of the cervix and 1 cancer of the uterine body detected on the first examinations.

For ten years, 742 of these women who were initially thirty to eighty years of age were followed more or less regularly. During the ten years, 1 adenocarcinoma of the cervix, 1 adenocarcinoma of the endometrium, 1 malignant cystic tumor of the ovary and 1 cancer of the anterior vaginal wall were discovered. In addition, 214 inflammatory lesions of the cervix were eliminated after discovery and 193 myomatous tumors of the uterus were recognized. It is concluded that every parous woman of thirty years or more in age should be examined once a year and that inflammatory lesions should be eliminated.—*John Turner, M.D.*

Costolow, William E. Management of Stage 1 carcinoma of the cervix uteri. *Ann. West. Med. & Surg.*, Nov., 1948, *2*, 506–509.

The author feels it is important to reconsider the management and results of treatment in Stage 1 carcinoma of the cervix since, while presumably curable in a high percentage of cases, about 1 patient in every 5 dies before five years have elapsed. Improvement in results depends upon utilization of more perfect methods of delivering adequate radiation, plus careful attention to important factors such as evaluation of stage of disease, with possibility of unrecognizable metastasis, histopathological grading, presence or absence of infection, and character of blood supply to the tumor bed.

In the authors group, 13 per cent (105 cases) of 2,173 cases of cervical cancer since 1922, were classified as Stage 1; 82.9 per cent of the cases

treated between 1922–1943 survived five years free from clinical evidence of disease. Seventy cases were available for ten year follow-up and 60 per cent of these survived without evidence of disease. During the second five year period about 9 per cent of patients died of recurrence and a small proportion died from causes other than cancer of the cervix; the chief loss in material during this second five year period is due to loss from follow-up. He estimates that, were it possible to project the same factors for follow-up in the second quinquennium as applied patients in the first, the survival rate should be about 74 per cent after ten years. It should be emphasized, therefore, that the five year survival should not be considered a criterion for absolute cure.

Since it has been shown that regional metastasis has already taken place in 25 to 50 per cent of operable Stage I cases, external roentgen therapy is an important adjuvant of intracavitary radium. Present external roentgen therapy in his group consists in the delivery of 3,500 to 5,000 r by 500 kv. apparatus in addition to intracavitary radium. He considers treatment by 3,000 milligram-hours intracavitary radium wholly inadequate.

Disadvantages of surgery alone are that the patient must be highly selected with exclusion of many because of constitutional reasons, and that the surgical procedure must be more extensive than the original Wertheim procedure. The mortality from such type of operation is low because of modern advances in anesthesia, physiology, and chemotherapy. He quotes Meigs, "At this time radiation is the proper treatment for cervical cancer. There will be no proof of the efficacy of modern American Surgery until a five-year report of 100 cases is made. Such a report will not be available until July, 1951." Surgical approach, combined with radiation therapy (Garcia and Menville) shows a definite advantage over surgery alone, and may be of particular use in cases not well handled by irradiation alone, such as Stage IV, in which the bladder and/or rectum must be sacrificed. Interstitial implantation of weak radium needles (Pitts and Waterman) requires individualization of cases, but permits radical radiation therapy with minimum destruction of normal structures and has given excellent results.

Costolow states that a pelvic wall dosage of 5,000 gamma roentgens may be delivered safely. Of the recently developed radium applicators, he feels that that developed by Ernst supplying multiple foci of radium about the cervix permits a larger safe dosage. The miniature "bomb" of Neary requires special heavy metal protection of the rectum and bladder.—*Angus K. Wilson, M.D.*

Hall, John W., and Friedman, Milton. Histologic changes in squamous-cell carcinoma of the mouth and oropharynx produced by fractionated external roentgen irradiation. *Radiology*, March, 1948, *50*, 318–350.

A detailed study of histopathological changes produced by fractionated external irradiation in squamous cell carcinoma of the mouth and oropharynx was made in 28 cases. Treatment was given with 200 kv. roentgen rays, 0.5 to 2 mm. Cu filter and a daily skin dose of 400 r (with backscatter). The average daily tumor dose was 275 r, and total tumor dose 6,000 to 6,500 r in twenty-three to twenty-eight days. Periodic biopsies were made during treatment.

Three major types of histopathological changes were noted. They were acute cell death, progressive enlargement to giant-sized tumor cells and radiation keratogenesis. Acute cell death was the most common radiation effect noted. It may occur twenty-four to forty-eight hours after the first treatment, and proceed so rapidly that by the seventh day 50 per cent or more of the tumor cells may have disappeared. The remaining less sensitive tumor cells undergo progressive enlargement. They become most numerous toward the end of the second week and usually disappear completely by the end of the seventh week. Tumors showing pleomorphism have a greater tendency toward giant cell formation during treatment.

The third mechanism whereby normal squamous epithelium and squamous cell carcinoma are destroyed by irradiation is through radiation keratogenosis, the acceleration in rate or degree of the normal process of keratinization. This is a destructive mechanism seen in varying degrees in most irradiated squamous cell carcinomas, and in an occasional tumor is the dominant mechanism. Radiation keratogenesis was most prominent in tumors showing slight to moderate keratinization.

Connective tissue seems to play little if any part in destruction of tumor cells. The changes are largely replacement fibrosis. No conclusions

could be drawn regarding relation between tumor sensitivity and vascular damage.

A single biopsy between the seventh and eleventh day will often demonstrate the effectiveness of the particular technique sufficiently early to permit its alteration if necessary. At this time 25 to 50 per cent of cells were found to be destroyed, and if destruction is most efficient, most of the destruction will have occurred by acute cell death. The common practice of avoiding severe local and general reactions by reducing the daily dose and extending treatment over a long period is inefficient. The tumor may mature and become more radioresistant.—*S. Friedman, M.D.*

Hamann, Anna. External irradiation with roentgen rays and radium in the treatment of human leukemias, lymphomas, and allied disorders of the hemopoietic system. *Radiology*, March, 1948, *50*, 378–386.

The results of treatment of 337 cases of leukemia, Hodgkin's disease, lymphosarcoma and polycythemia rubra vera are reviewed.

Patients with generalized disease were given the minimum doses necessary to produce a remission. In local manifestations of Hodgkin's disease and lymphosarcoma a tumor dose of 2,000 to 4,000 r was delivered. All patients were treated with 135 kv. or 200 kv. therapy. Total body irradiation was used in patients with advanced disease with decreased response to local irradiation.

Results of Treatment

Chronic myelogenous leukemia: Six of 49 patients lived over five years with an average survival of six years and five months. The average survival of 35 patients followed until death was thirty-three months.

Chronic lymphatic leukemia: Eight of 51 patients lived over five years. The average survival of 30 patients, followed until death, was thirty months. In elderly people chronic lymphatic leukemia frequently pursues a relatively benign course and 7 of the 8 five year survivors were over fifty years of age at the onset of the disease. Patients with lymphatic leukemia require less irradiation for control of symptoms than those with myeloid leukemia.

Acute leukemia: All patients died within three months after the onset of symptoms regardless of treatment.

Lymphosarcoma: Three of 77 patients lived longer than five years. Only 12 per cent lived over three years.

Hodgkin's disease: Seven of 143 patients lived for more than ten years and 26 lived for five years or more.

Polycythemia rubra vera: The results of roentgen therapy are not very gratifying with the conventional dosage. In only 1 patient who received the high surface dose of 600 r over each of ten bones was a remission of eleven months observed. A second course with conventional dosage was much less effective. Relatively high roentgen-ray doses are required for effective treatment of polycythemia and such doses cannot be repeated frequently without risk.—*Howard R. Crews, M.D.*

Spurr, Charles L., Smith, Taylor R., and Jacobson, Leon O. Chemotherapy in human lymphomas, leukemias, and allied disorders of the hemopoietic system. *Radiology*, March, 1948, *50*, 387–394.

Over a four year period nitrogen mustard was used in a variety of malignant diseases affecting the hemopoietic system. Daily doses of 0.1 mg. per kilogram of body weight were given in courses of four injections on consecutive days. The immediate toxic reactions consist of nausea and vomiting which usually disappears within two or three hours. Peripheral blood changes consist of lymphopenia, leukopenia and thromobocytopenia. There is evidence of regeneration of the myeloid and erythroid by the end of the third week and the marrow returns to normal in approximately eight weeks.

In a group of 40 patients with Hodgkin's disease 14 received nitrogen mustard therapy after extensive roentgen irradiation produced only partial remissions. Seven patients responded well, 2 failed to respond and 5 had remissions of three to ten months with subsequent deaths. These results suggest the value of nitrogen mustard therapy in conjunction with roentgen therapy.

There is a marked variation in the response of lymphosarcoma. Eight patients were treated. Two patients showed no response. Six patients have had remissions with repeated courses for a period of eight to thirty-six months.

Seven cases of polycythemia were treated. The remissions varied from four to twelve months.

There is no indication that remissions were obtained in reticulum cell sarcoma, acute leuke-

mia, multiple myeloma and sympathicoblastoma.—*Howard R. Crews, M.D.*

Karnofsky, D. A. Chemotherapy of neoplastic disease. I. Methods of approach. New *England J. Med.*, Aug. 5, 1948, *239*, 226–231.

Chemotherapeutic efforts against tumors usually select a vulnerable point in the neoplastic process. Colchicine attacks the cell in mitosis, estrogens affect tumor cell environment, Shear's polysaccharide damages tumor blood supply, and radioiodine exerts its selective effect via a selected process in cell metabolism.

Current laboratory study of chemotherapeutic agents utilizes a wide variety of test objects, sample tumors, and in vitro or in vivo methods. Most commonly used are mice bred for high tumor susceptibility. Common mouse test tumors are sarcoma 37, sarcoma 190, and transmitted leukemia.

Response is judged by tumor appearance after treatment, by animal survival times, or by effect on percentage of takes in transplantable tumors. Cytocidal techniques determining dosages needed to destroy transmission viability of tumor cells are also used. Effects of chemotherapeutic agents may also be studied in tumor tissue growing on chorioallantoic chick membrane, or explanted in tissue culture.

Clinical evaluation of chemotherapeutic agents is usually difficult, especially with agents that are palliative rather than curative. Complete coherent critical study of each pharmacological agent is necessary.—*Henry P. Brean, M.D.*

Karnofsky, D. A. Chemotherapy of neoplastic disease. II. Trends in experimental cancer therapy. *New England J. Med.*, Aug. 12, 1948, *239*, 260–270.

The author enumerates and evaluates those substances which have been reported to be effective agents against tumor growth in recent years. Biologic products such as Shear's polysaccharide, Coley's toxins, K-R, A.C.S., and myelokentric acid are reviewed. The action of folic acid antagonists, adrenocortical hormones, estrogen hormones and related products are discussed.

The basic data on cell poisons such as the nitrogen mustards, urethane, colchicine, and podophyllin is detailed. The potential application of hydrocarbon carcinogens in tumor therapy, and of the radioactive substances now being studied, is discussed. A large number of other compounds are also reviewed in considerable detail, for which the original article should be consulted.—*Henry P. Brean, M.D.*

Karnofsky, D. A. Chemotherapy of neoplastic disease. III. Agents of clinical value. *New England J. Med.*, Aug. 19, 1948, *239*, 299–305.

Only a few of the many substances potentially valuable in tumor therapy are known to be clinically useful. The author lists those agents which he believes to be of value in the management of patients with neoplastic disease. They are critically reviewed, being listed in order of clinical value as estimated by the author, beginning with estrogen therapy and orchidectomy for prostatic cancer. Indications, preparations of choice, modes of administration, and toxicity are described for each agent.

Other agents reviewed are, in order of estimated value, nitrogen mustard, radioactive iodine, androgens in cancer of the breast, radioactive phosphorus urethane, and Fowler's solution.—*Henry. P. Brean, M.D.*

Donnelley, Grace C., and Bauld, A. G. Aspects in the treatment of vulvar and cervical carcinoma. *Am. J. Obst. & Gynec.*, Sept., 1948, *56*, 494–501.

Review of female pelvic malignancies from 1926 to 1945 in the Radium Clinic, Royal Victoria Maternity Hospital, Montreal, and the Department of Obstetrics and Gynecology, McGill University, revealed three groups of interest. These groups are carcinoma of the vulva, carcinoma in the cervical stump, and selected cases of cervical carcinoma treated by irradiation and surgery.

There were 40 cases of carcinoma of the vulva. Prior to 1940, 30 were treated with various combinations of irradiation and surgery or one or the other alone. Subsequent studies indicated that excision or vulvectomy produced more survivals. Two of the 10 remaining cases were treated by diathermy excision and 8 by diathermy vulvectomy. These 10 showed a five year survival of 23.33 per cent. Local recurrences are not common.

No additional treatment was directed to the inguinal nodes unless clinical involvement existed at that time. Metastases occurring later were not uncommon. Recently, this clinic has

been treating the inguinal gland region initially, either by surgery or irradiation.

The main objection to diathermic vulvectomy is the subsequent slow healing.

Forty-eight cases of stump carcinoma were found. Five of these were uterine carcinoma, 3 were associated with pregnancy, and 43 were cervical in origin. A true stump carcinoma is counted as one which occurs two or more years after subtotal hysterectomy. If the period is shorter, the carcinoma is thought to have been present at the time of hysterectomy. Twenty-eight of the 48 total were true cervical stump carcinoma.

Two apparently good results were obtained by surgical removal of the stump following irradiation in patients presenting uterine carcinoma of the stump. In all those cases associated with pregnancy, extensive spread was present. Radium therapy following Porro section produced only one three and a half year survival.

Of the 28 cervical stump cases, 12 probably had carcinoma at the time of subtotal hysterectomy. In 8 of these 12, the lesion was not apparent before operation. Seven were treated with radium and roentgen irradiation and 5 with radium alone. Two are living and well at the end of five years and one at the end of fifteen years.

In the majority of cases, the carcinoma was diagnosed ten or more years after operation, so that it can be assumed the cervix was devoid of carcinoma at the time of surgery.

Thirty-nine per cent of the cases had had bilateral oophorectomy at the time of subtotal hysterectomy, so that it would seem to contradict the theory that carcinoma of the cervix is influenced by ovarian stimulation.

A small group of selected cases, consisting of Stages I and II, and some in Stage III have been subjected to irradiation followed by surgery. The surgery was usually panhysterectomy. Six months elapsed between irradiation and surgery. The late complications and poor results in follow-up were mainly in the Stage. III group. The five year survival rate in these selected cases was 75 per cent, or 18 of 24 cases. Ten year survivals indicate that late recurrences may be reduced by this method of treatment.—*Mary Helen Cameron, M.D.*

Speert, Harold, and Peightal, Thomas C. An evaluation of adjunctive radiotherapy in the surgical treatment of endometrial carcinoma. *Am. J. Obst. & Gynec.*, Sept., 1948, *56* 502–508.

This article maintains that valid statistical evidence is lacking to demonstrate improvements in survival rates when radium or roentgen irradiation or both are used in connection with total hysterectomy in the treatment of carcinoma of the uterine body. There are short reviews of many previously published series together with reasons why the authors believe the statistics therein are not acceptable.

Cases should be classified as early, intermediate, or advanced by pathologic examination. Histopathologic grading should also be done.

End results of various treatment methods are thought not to be comparable unless the groups contain about the same proportions of early and advanced cases, and of low and high histopathologic grading.

One hundred fifty-seven cases were reviewed, the absolute survival of which was 50 per cent. Because the authors' cases did not comply with the above categories, the cure rates were expressed for the clinical stages and pathologic gradings.

An 85 per cent five year cure rate was obtained by hysterectomy alone in the early cases. Preoperative radium or postoperative roentgen irradiation produced no increase in this rate. The same observation was true for histopathologic Grade 1 cases, with a 91 per cent cure rate.

However, in far advanced cases, a tentative observation is made that the cure rate is twice as high in those patients receiving irradiation in addition to surgery, as in those receiving only surgery. There probably also is benefit in high histopathologic grade tumors by postoperative irradiation.—*Mary Helen Cameron, M.D.*

Munnell, Equinn W., and Brunschwig, Alexander. Five year end-results of irradiation therapy of cancer of the cervix uteri at the Memorial Hospital. *Surg., Gynec. & Obst.*, Sept., 1948, *87*, 343–348.

It is the purpose of this paper to present the five year end results in 1,072 patients with cancer of the cervix seen at Memorial Hospital in the period 1934–1941 inclusive. The five year overall cure rate for the 1,037 patients treated by irradiation was 28.6 per cent.

The conclusion to be drawn from these studies is that there appears to be little consist-

ent amelioration in results of the management of carcinoma of the cervix during the years studied. A perusal of reports concerning the results of radiation therapy for carcinoma of the cervix carried out in widely scattered centers leads to a similar impression. It therefore follows that the question must be raised as to whether or not the exclusively radiotherapeutic management of cervix carcinoma should continue to be pursued without some form of combination with surgical attack. The continued repetition in standard texts, even of recent date, that radical hysterectomy for cervix carcinoma is accompanied by a high mortality rate has been a strong influence in discouraging surgical attempts in this field. However, Meigs has shown that modern surgical effort in an appreciable series of selected patients should not entail significant mortality and therefore the argument of mortality does not now have the force which it did two decades or more in the past.

The problem is not one of radiation therapy versus surgery; it is: what can be done to increase progressively the incidence of cure in carcinoma of the cervix uteri?—*Mary Frances Vastine, M.D.*

Kardash, Theodore. Sarcoma of the uterus; report of two cases with generalized metastasis. *Am. J. Obst. & Gynec.*, Sept., 1948, *56*, 566–573.

Sarcoma of the uterus is rare. It constitutes 1.7 per cent of uterine malignancies. From 1937 to 1946, eight cases in addition to the 2 reported in this article have been seen. Of these, 3 were primary, and 7 were secondary to uterine myoma. Eight were in white patients and 2 in Negroes. The diagnosis was not made preoperatively in any instance, probably due to the varying symptomatology. Nine had palpable masses on admission.

Five patients were subjected to supravaginal hysterectomy; 1 to panhysterectomy; 1 to laparotomy; 1 to dilatation, curettage, and radium; 1 to dilatation, curettage and roentgen irradiation, and 1 to irradiation alone.

Six of the patients died of malignancy within three months of admission. One died of cardiac disease twenty months after surgery. Three are alive and without symptoms; the length of time is not stated.

To improve results, the author suggests that (1) enlarging fibromas and those causing symptoms be removed, (2) roentgen examination of the chest be done in suspected cases as blood borne metastases are early and frequent, and (3) specimens be opened at the operating table and rapid section done on suspicious areas.

Two cases of uterine sarcoma with metastases are presented in entirety.—*Mary Helen Cameron, M.D.*

Sauer, Hans R., Macmanus, Joseph E., and Blick, Michael S. Primary malignant neoplasms of the vesicovaginal septum. *Cancer*, Sept., 1948, *1*, 419–426.

This rare tumor is reported by the authors with a brief review of the few references in the literature. Nonepithelial tumors in this location seem to present an unusually confusing histopathological picture.

A group of pathologists reviewing the same slide gave the following diagnoses:

(1) Carcinoma simplex—low grade.
(2) Malignant epithelial tumor.
(3) Renal cell carcinoma.
(4) Metastatic adenocarcinoma.
(5) Carotid body like tumor.

It is the authors' opinion that these tumors are usually mixed and contain both radioresistant as well radioresponsive elements. They thus conclude that irradiation can offer nothing but palliation and that extreme radical surgery offers the only possibility of cure.—*W. E. Childs. M.D.*

Ormond, J. K., and Best, J. W. Prognosis of testicular tumors. *J. Urol.*, Aug., 1948, *60*, 272–279.

This report is based on a series of 40 cases of malignant tumors of the testicle seen at the Henry Ford Hospital between 1923 and 1946. During these years approximately 500,000 patients were seen in the hospital, indicating the rarity of the condition.

The authors suggest the following classification;

A—Teratoma (Heterologous)
  1. Mixed tumor or adult teratoma.
  2. Embryonal carcinoma.
  chorioepithelioma.
B—Seminoma (Homologous)
C—Interstitial cell tumor

Metastases occur early, usually by way of the lymphatics to the periaortic nodes, the regional nodes, and to the chest by way of the subdiaphragmatic and mediastinal nodes. There is

no direct lymphatic route from the testicle to the superficial inguinal nodes.

The authors divide their 40 cases into two groups; Group I comprising 8 cases, includes all patients thirty years or less of age, and Group II includes the remaining 32 cases, over thirty years of age. The average age was 37.8 years.

The commonest complaint was of painless gradual testicular enlargement. The duration of symptoms was shorter in the younger age group. Other symptoms included local pain and pain due to metastases, and hematuria. Only 10 per cent had a history of trauma. In the authors' series the hormone test was of no value in diagnosis or prognosis.

Of the authors' series 47.6 per cent were embryonal carcinoma, 20 per cent were teratoma, and 15 per cent seminoma; 35 per cent had metastases when first seen. The retroperitoneal nodes, mediastinal nodes and lung fields were the usual sites of metastasis.

Five cases of Group I had metastases when first seen. All were treated by orchiectomy and postoperative roentgen therapy. Four are known dead and the fifth in a terminal condition, at the last consultation.

Nine patients from Group II had metastases when first seen. Of these 7 are known dead and the other 2 terminal.

The treatment of choice is orchiectomy, high ligation of the cord, and postoperative deep roentgen therapy.

Of the 26 cases who had no known metastases 17 have survived for over three years. The authors have had no deaths after the first year of patients presenting without demonstrable metastases and treated by orchiectomy and postoperative roentgen therapy—*Rolfe M. Harvey, M.D.*

Leucutia, T., Evans, William A., and Cook, James C. Radiation therapy of malignant tumors of the testis. *Radiology*. Aug., 1948, *51*, 177–187.

Excellent review of the literature with addition of 110 well documented cases. Treatment of the authors' cases was largely simple orchiectomy followed by extensive irradiation. Age grouping followed other investigators' reports. Seminoma occurs at a slightly older age than malignant teratoma. Trauma was significant in these cases by calling attention to the tumor early. Duration of symptoms has some effect on results. Early diagnosis helps prognosis. Known metastasis at start of treatment influences the statistics unfavorably. The two year survival rate proved a good prognostic index. Treatment with radiation therapy added to surgery was markedly superior to simple orchiectomy.—*E. C. Baker, M.D.*

Hawley, Sydney J. Rotation therapy; theory and clinical applications. *Radiology*, August, 1948, *51*, 205–213.

In its simplest form, rotation therapy consists of turning the patient slowly (360° per minute) on a turntable with a stationary roentgen therapy tube centered on a deep-seated lesion. By this method it is stated that a higher tumor dose can be given without skin damage, than by the conventional multiple port method of treatment. The author feels that with comparable tumor doses there is less constitutional reaction when rotation therapy is used.

This method is most efficient when the body irradiated is nearly cylindrical with the lesion being treated in the center. For peripheral lesions and irregularly shaped bodies, its advantages are questionable.—*Robert P. Barden, M.D.*

Kaplan, Ira, I., and Etkin, Sidney I. Treatment of deep-seated malignant tumors with multiple port technic simulating rotation therapy. *Radiology*, August, 1948, *51*, *188*–204.

Radiation of tumors of esophagus and lung has been difficult. Rotation therapy has been used to get better tumor doses. Therapy through multiple fixed ports will theoretically allow proper tumor dosage. Multiple fields 7 by 15 cm. using the "Demy protractor" for localization have permitted tumor doses of 5,700 to 6,300 r. Case reports are given. This method of irradiation shows promise.—*E. C. Baker, M.D.*